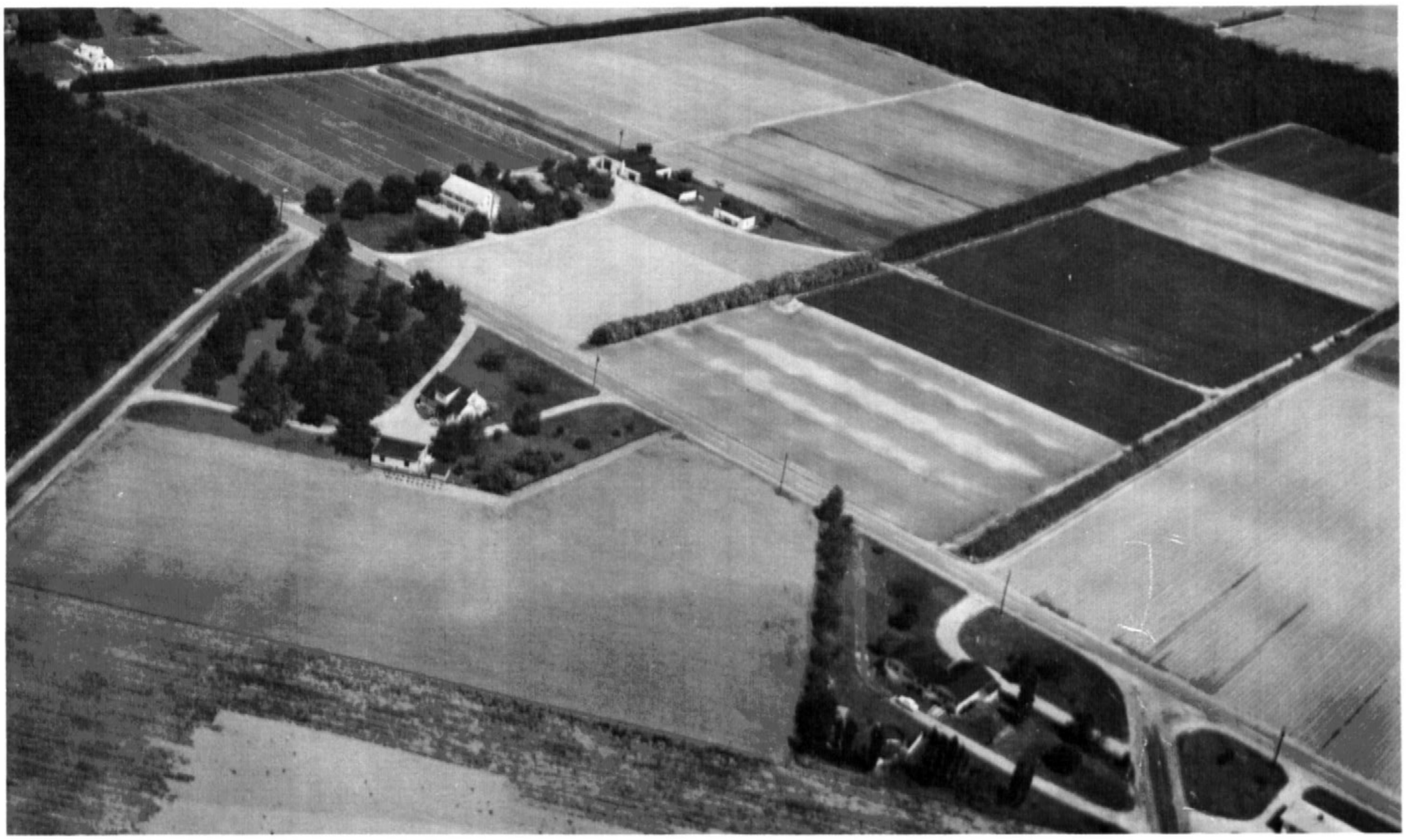
SOIL SURVEY OF

Atlantic County, New Jersey



United States Department of Agriculture
Soil Conservation Service
in cooperation with
New Jersey Agricultural Experiment Station,
Cook College, Rutgers, the State University
and the
New Jersey Department of Agriculture
State Soil Conservation Committee

This is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and agencies of the States, usually the Agricultural Experiment Stations. In some surveys, other Federal and local agencies also contribute. The Soil Conservation Service has leadership for the Federal part of the National Cooperative Soil Survey. In line with Department of Agriculture policies, benefits of this program are available to all who need the information, regardless of race, color, national origin, sex, religion, marital status, or age.

Major fieldwork for this soil survey was completed in the period 1968–73. Soil names and descriptions were approved in 1974. Unless otherwise indicated, statements in the publication refer to conditions in the county in 1973. This survey was made cooperatively by the Soil Conservation Service, the New Jersey Agricultural Experiment Station, Cook College, Rutgers, the State University, and the New Jersey Department of Agriculture State Soil Conservation Committee. It is part of the technical assistance furnished to the Cape-Atlantic Soil Conservation District. The Board of Freeholders of Atlantic County provided financial assistance to complete this survey.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and woodlands; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, wildlife habitat, and recreation.

Locating Soils

All the soils of Atlantic County are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise it is outside, and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the woodland group in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Transparent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those that have a moderate limitation can be colored yellow, and those that have a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from the soil descriptions and from the discussions of the capability units and the woodland suitability groups.

Foresters and others can refer to the section "Woodland," where the soils of the county are grouped according to their suitability for trees.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife."

Community planners and others can read about soil properties that affect the choice of sites for dwellings, industrial buildings, and recreation areas in the section "Town and Country Planning."

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of the Soils."

Newcomers in Atlantic County may be especially interested in the "General Soil Map" section, where broad patterns of soils are described. They may also be interested in the information about the county given at the beginning of the publication and in the information given in the "Climate" section near the end of this publication.

Cover: Typical sandy soils that are used to produce high-value vegetables. Privet windbreaks provide protection from soil blowing.

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Issued April 1978

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SOIL SURVEY OF ATLANTIC COUNTY, NEW JERSEY

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SOILS SURVEYED BY JOHN H. JOHNSON, THORNTON J. F. HOLE, AND VAN ROGER POWLEY, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, IN COOPERATION WITH THE NEW JERSEY AGRICULTURAL EXPERIMENT STATION, COOK COLLEGE, RUTGERS, THE STATE UNIVERSITY, AND THE NEW JERSEY DEPARTMENT OF AGRICULTURE, STATE SOIL CONSERVATION COMMITTEE

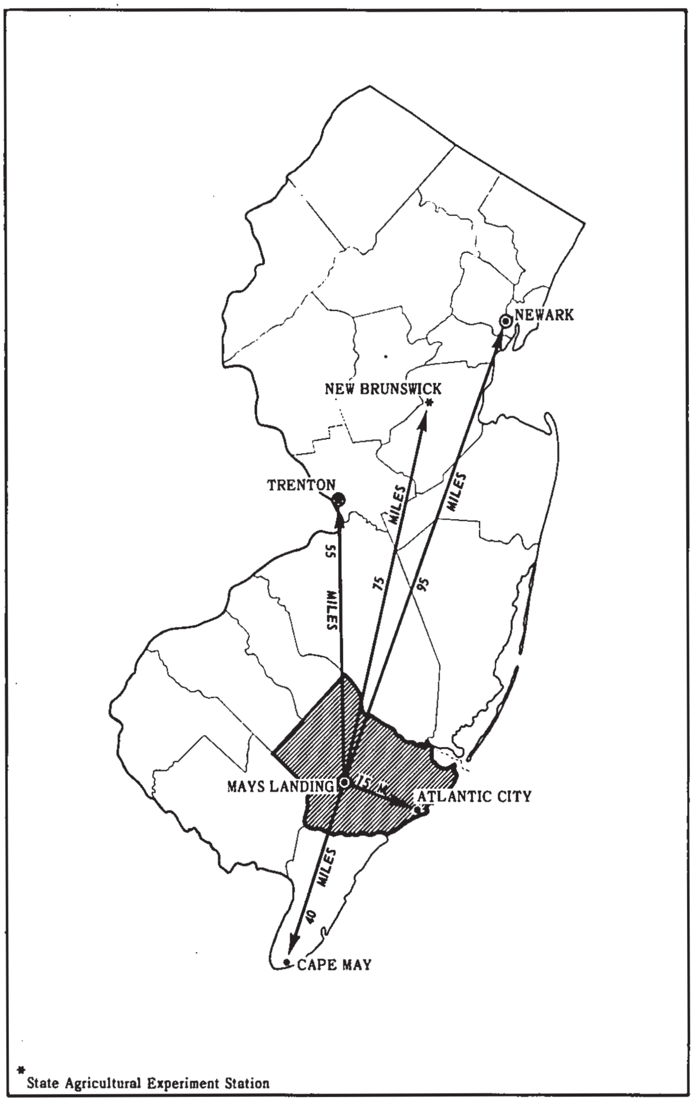

Figure 1.—Location of Atlantic County in New Jersey.

ATLANTIC COUNTY is in the southeastern part of New Jersey (fig. 1). It has an area of 364,224 acres. The county is bordered on the east side by the Atlantic Ocean, on the south side by the Tuckahoe River and Cape May County, and on the north side by the Mullica River and Burlington County. Parts of Camden, Gloucester, and Cumberland Counties also border Atlantic County. The major streams in the county are the Mullica, Egg Harbor, and Tuckahoe Rivers. All flow east to the Atlantic Ocean. Tidal flats and coastal beaches make up about 15 percent of the county.

The population of Atlantic County is about 175,000. Most of it is concentrated in a strip along the coast. Atlantic City, with a total of 47,854 inhabitants, has the largest population of any urban area in the county. Mays Landing, the county seat, has about 5,000 inhabitants. Vacationers greatly increase the population of the county during the summer months.

Resort and convention businesses are of major importance in Atlantic County. Most farms produce fruits and vegetables, and many acres of blueberries are grown in cultivated areas. One large Federal installation—the National Aviation Facilities Experimental Center—is in the county, and the federally owned Brigantine Wildlife Refuge is also there. A small part of Wharton State Forest is in the northern part of Atlantic County.

The highest elevations in the county, approximately 120 feet above sea level, are in the Borough of Buena and the town of Hammonton.

Approximately 15 percent of the county is used for intensive farming, 12 percent is urbanized, and 60 percent is wooded. The rest is Tidal marsh.

Industrial operations in Atlantic County include ceramic and cement manufacturing, clothing manufacturing, boat building, and wine manufacturing.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Atlantic County, where they are located, and how they can be used. They went into the county knowing that they probably would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed greatly by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these with others in nearby counties and in more distant places. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Hammonton and Aura, for example, are the names of two soil series. All the soils in the United States that have the same series name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Hammonton loamy sand, clayey substratum, 0 to 2 percent slopes, is one of several phases in the Hammonton series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this survey was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of other kinds that have been seen in an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. One such kind of mapping unit is shown on the soil map of Atlantic County: the soil complex.

A soil complex consists of areas of two or more soils (or land types), so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils; the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils or land types joined by a hyphen. Coastal beach-Urban land complex is an example.

In most areas surveyed there are places where the soil material is so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are descriptive names. Tidal marsh, deep, and Muck are examples.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kind of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kind of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants, and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil. They relate this to the slow permeability of the soil or its high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil. They relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available re-

search data, to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Atlantic County. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in a county, who want to compare different parts of a county, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreation facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in Atlantic County are discussed in the following pages.

1. Downer-Hammonton-Sassafras Association

Nearly level or gently sloping, well drained to somewhat poorly drained soils that have a loamy subsoil

The association (fig. 2) occupies 34 percent of the county. It is about 48 percent Downer soils, 14 percent

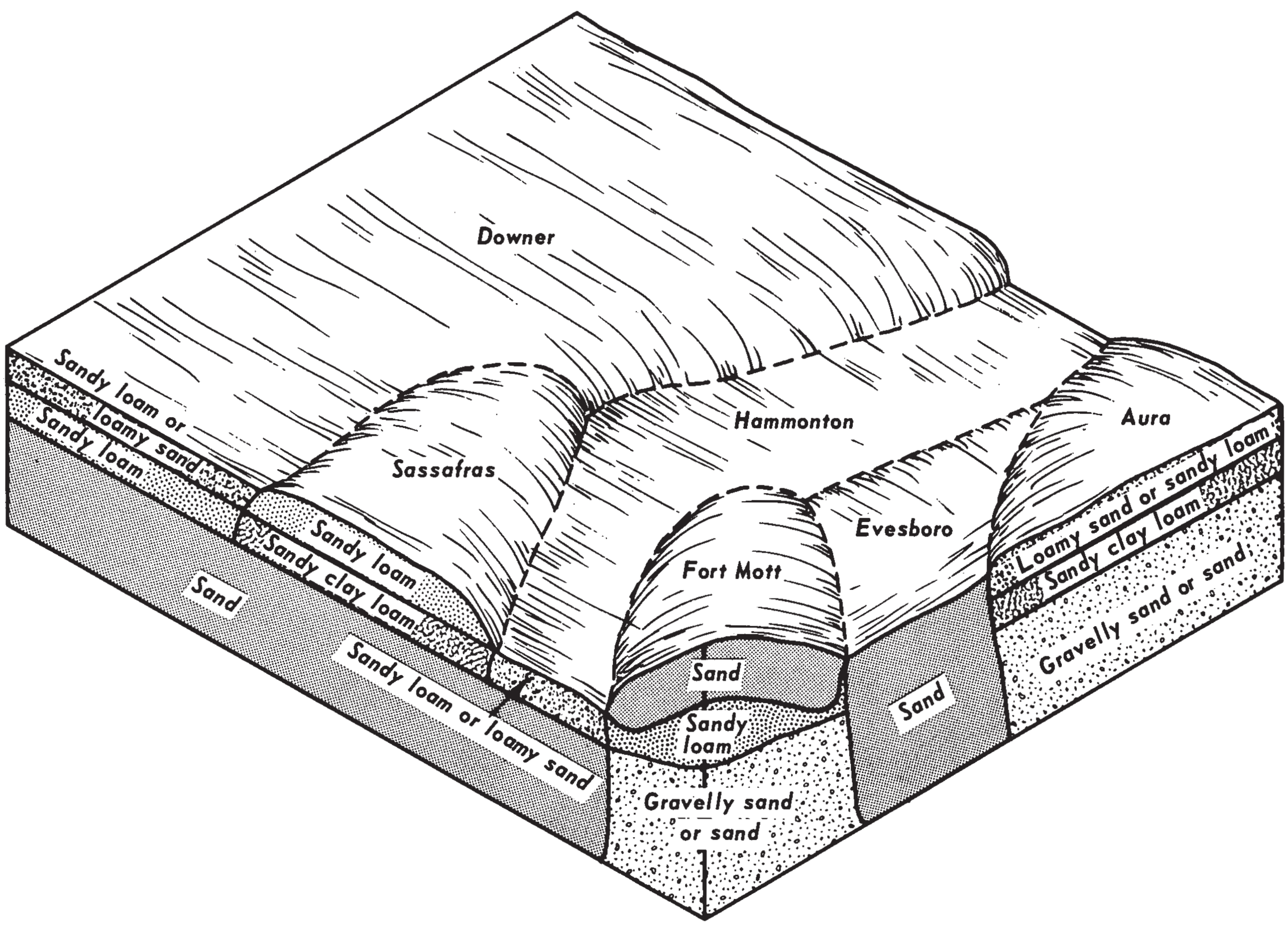

Figure 2.—Typical soil pattern in Downer-Hammonton-Sassafras association.

Hammonton soils, 6 percent Sassafras soils, and 32 percent minor soils. It is dominantly in the eastern part of the county but occurs in nearly all parts of the county.

All of the major soils are in high or intermediate positions on the landscape. The Downer soils are in high positions. They are well drained and have a loamy subsoil and a sandy or loamy surface layer. The Hammonton soils are in intermediate positions on the landscape. They are moderately well drained or somewhat poorly drained and have a loamy subsoil and a sandy or loamy surface layer. In places the Hammonton soils have a clayey substratum. The Sassafras soils are in high positions. They are well drained and have a loamy surface layer and subsoil.

The minor soils in this association are in the Aura, Evesboro, Fort Mott, Lakehurst, and Klej series. Also in this association are a number of sand or gravel pits. The minor soils are well drained to somewhat poorly drained. Some Evesboro and Klej soils have a clayey substratum.

Most of the area of this association is wooded. Large areas, especially around Hammonton, have been cleared for farming. The crops most commonly grown are fruit and vegetables.

2. Sassafras-Aura-Woodstown Association

Nearly level or gently sloping, well drained and moderately well drained soils that have a loamy subsoil

This association (fig. 3) occupies 12 percent of the county. It is about 34 percent Sassafras soils, 32 percent Aura soils, 10 percent Woodstown soils, and 24 percent minor soils. It is in the eastern part of the county at an elevation of about 60 feet and in the western part of the county at an elevation of about 100 feet.

The Aura and Sassafras soils are at the highest positions on the landscape. These soils are well drained. The Woodstown soils are in intermediate positions, and they are moderately well drained. All of the major soils have a loamy or sandy surface layer and a loamy subsoil. In places the Aura soils are gravelly.

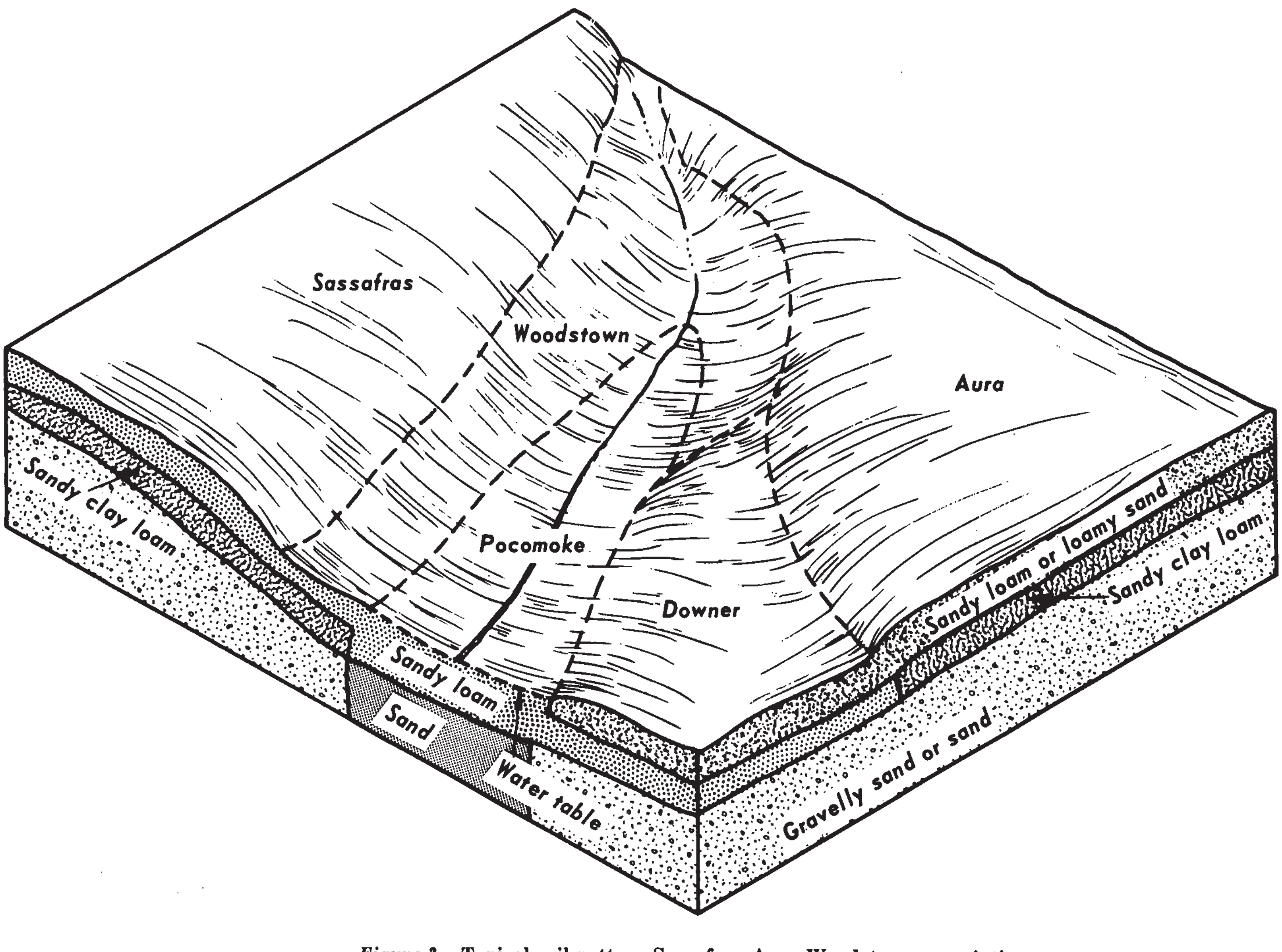

***Figure 3.*—Typical soil pattern Sassafras-Aura-Woodstown association.**

The minor soils and land types in this association are Downer, Matawan, and Pocomoke soils and Fill land. They range from well drained to very poorly drained. Also in this association are a number of sand and gravel pits. Some have been excavated to ground-water level.

About half of the area of this association has been cleared for farming. The soils are more extensively farmed than those of other associations. Fruits and vegetables are the crops most commonly grown. High-value crops are irrigated. Wooded areas are dominantly in oak and hickory. The Woodstown soils are more limited for urban uses than the other major soils. Their limitation is the result of a fluctuating water table that ranges, during peak periods, from 1½ to 4 feet below the surface.

3. Klej-Lakehurst-Evesboro Association

Nearly level to gently sloping, excessively drained to somewhat poorly drained soils that have a sandy subsoil

This association (fig. 4) occupies 16 percent of the county. It is about 33 percent Klej soils, 25 percent Lakehurst soils, 15 percent Evesboro soils, and 27 percent minor soils. It is in fairly large areas south of the Mullica and Penny Pot Rivers and on both the east and west sides of Great Harbor River.

All of the major soils are in high or intermediate positions on the landscape. The Evesboro soils are in high positions. They are excessively drained. The adjacent Lakehurst and Klej soils are in intermediate positions. These soils are moderately well drained to somewhat poorly drained, and they have a fluctuating water table that ranges, during peak periods, from 1½ to 4 feet below the surface. All of the major soils are very sandy and low in natural fertility. In summer when the water table drops, these soils become droughty. Some Klej and Evesboro soils have clayey underlying material.

The minor soils in this association are in the Lakewood and Atsion series. Also in this association are a number of sand pits. The Lakewood soils are sandy and excessively drained. The Atsion soils are poorly drained and sandy.

Most of the area of this association is in either pine or oak trees. About 10 percent of the acreage of the Klej and Evesboro soils is used for growing fruit and

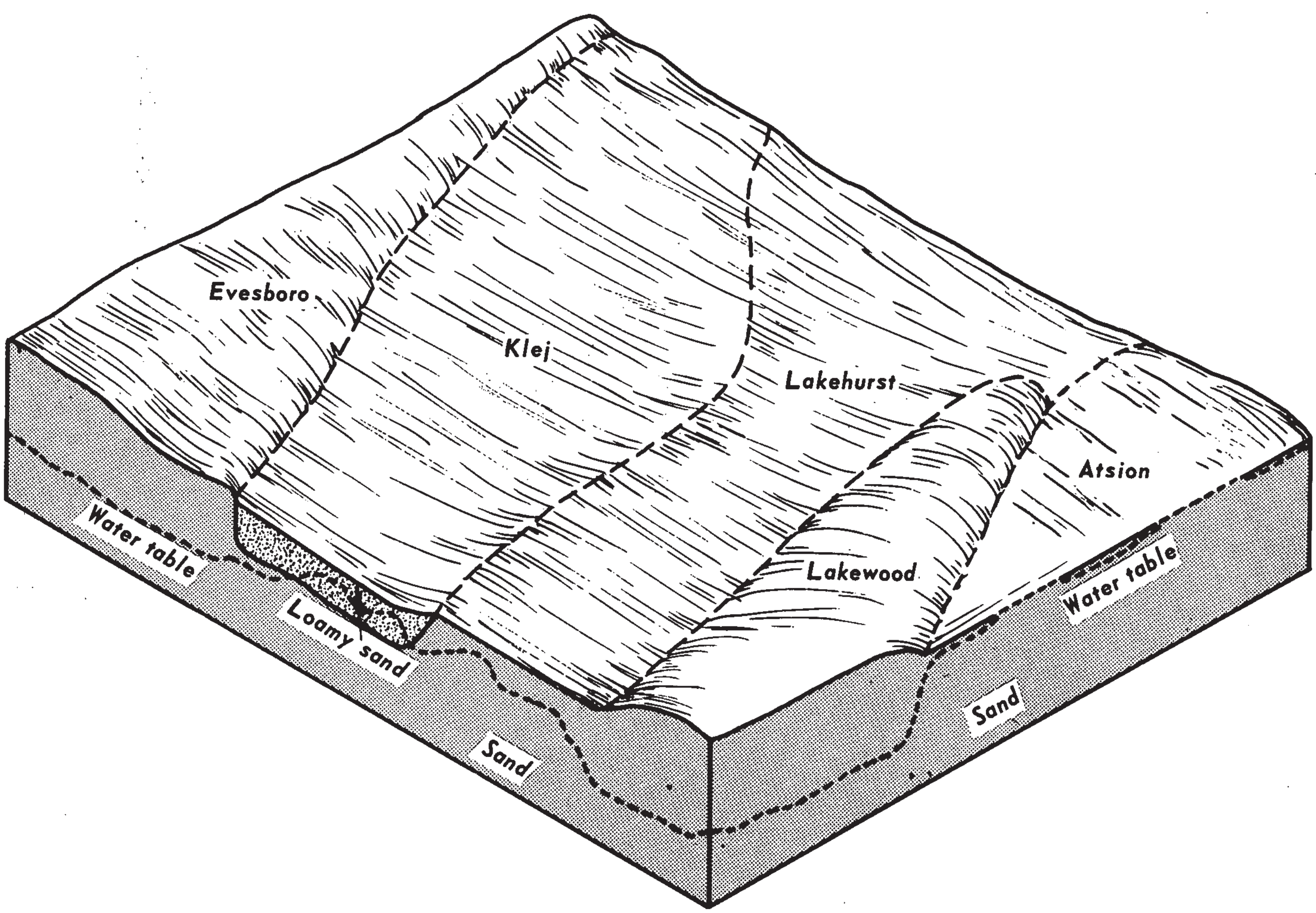

Figure 4.—Typical soil pattern in Klej-Lakehurst-Evesboro association.

vegetables. Very few areas of Lakehurst soils are farmed because of the very low fertility and the low available water capacity. Because the soils in this association are sandy, large areas are subject to soil blowing where the soil is clean tilled (fig. 5) or is left unprotected in winter. If used for urban purposes, Klej and Lakehurst soils have limitations caused by fluctuating water tables. Lawns and landscape plants are limited by the deep, sandy soils.

4. Atsion-Muck-Pocomoke Association

Nearly level, poorly drained and very poorly drained soils that have a sandy or loamy subsoil, and organic soils underlain mainly by sand

This association (fig. 6) occupies 23 percent of the county. It is about 31 percent Atsion soils, 29 percent Muck, 23 percent Pocomoke soils, and 17 percent minor soils.

The soils of this association are in the lowest parts of the landscape that are drained by freshwater. Atsion soils are sandy throughout, and they are poorly drained. Muck has a highly organic surface layer more than 16 inches thick and is very poorly drained. Pocomoke soils have a surface layer and subsoil of sandy loam. These soils are very poorly drained. All of the major soils have seasonal high water tables that range, in depth, from the surface to 1 foot below it.

The minor soils in this association are in the Berryland, Klej, Lakehurst, and Hammonton series. They range from moderately well drained to very poorly drained but are mainly very poorly drained.

Extensive areas of Atsion and Pocomoke soils and some areas of Berryland soils were cleared, and parts of these areas were drained for the production of cranberries in the 1870's. During the 50-year period before 1973, several thousand acres were converted for blueberry production (fig. 7). The remaining area is still in pitch pine, sweetgum, red maple, or Atlantic white-cedar. Drainage of these soils is expensive and difficult. The soils are well suited to ground-water ponds.

The soils in this association have very severe limitations for urban use. All of the major soils have a seasonal high water table. In addition, some areas of Berryland soils and all areas of Muck are frequently flooded. Muck has a low bearing capacity.

5. Tidal Marsh-Fill Land-Coastal Beach Association

Nearly level, poorly drained tidal flats; nearly level,

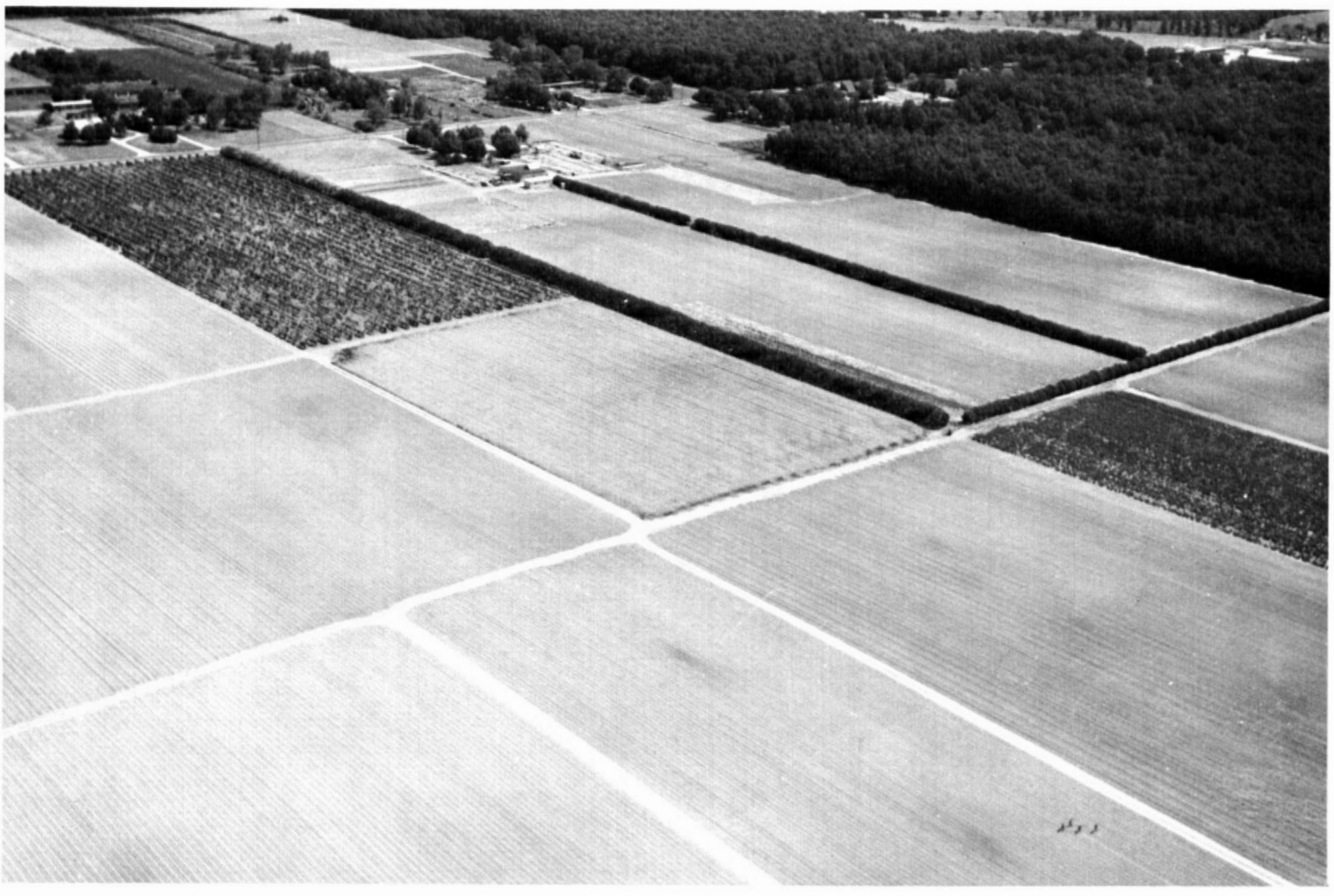

***Figure 5.*—Privet windbreaks protect sandy soils from soil blowing.**

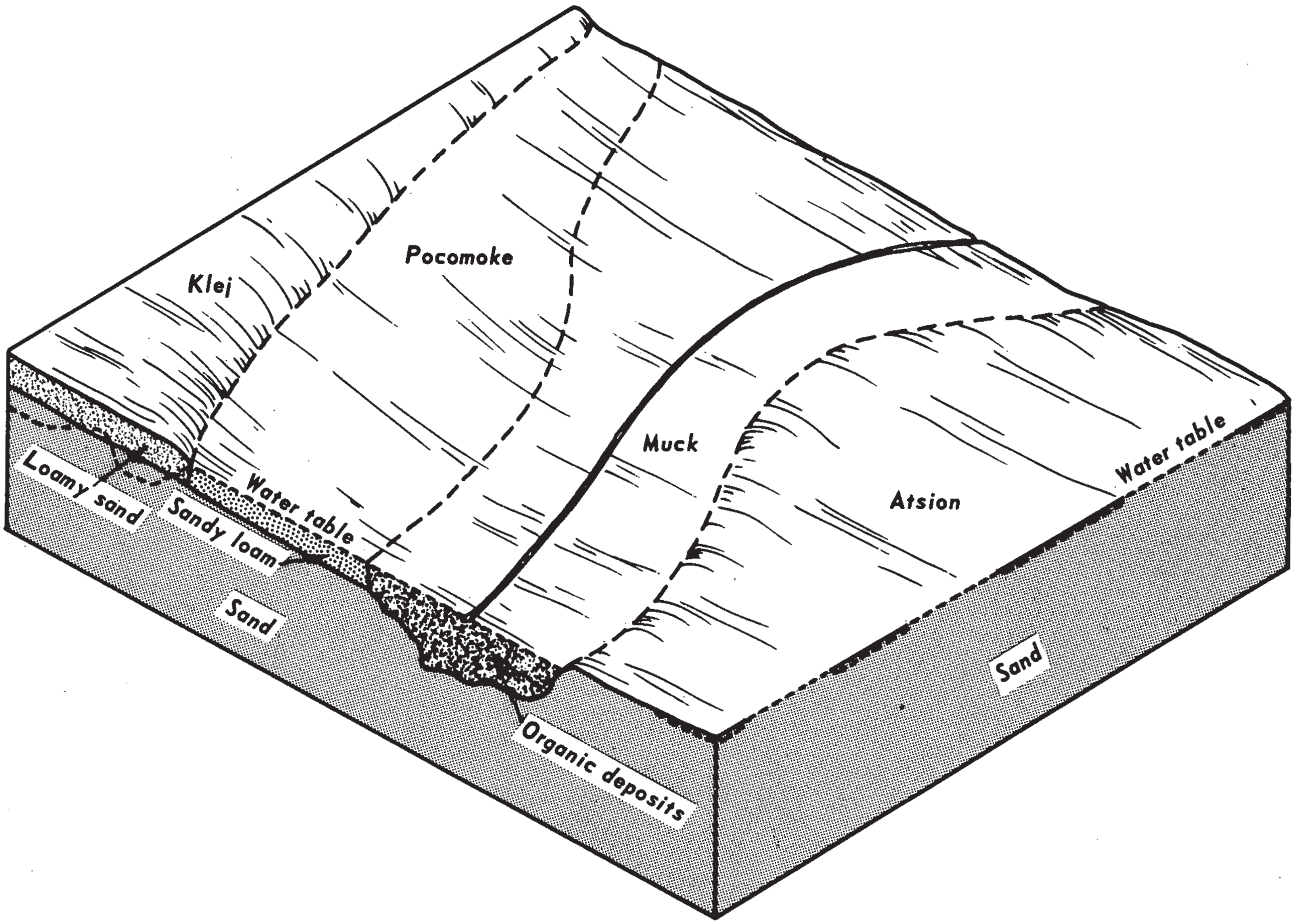

Figure 6.—**Typical soil pattern in Atsion-Muck-Pocomoke association.**

excessively drained sandy Fill land; and nearly level or gently sloping, excessively drained coastal beaches

This association (fig. 8) occupies 15 percent of the county. It is 75 percent Tidal marsh, 12 percent Fill land, 5 percent Coastal beach, and 8 percent minor soils.

Tidal marsh consists of sea-level flats that are flooded twice daily by tidal waters. Where these marshes are near the ocean or bays, the water is saline. Upstream along the Mullica River, tidal waters are brackish or fresh. Vegetation on the tidal flats varies in proportion to the salt content of the tidal waters. Near Tuckahoe, several freshwater impoundments have been constructed to improve the habitat for waterfowl. The Brigantine Wildlife Refuge Impoundment at Oceanville provides food and resting areas for migrating waterfowl. Fill land over Tidal marsh in this association was made by piling several feet of sandy fill on Tidal marsh. These areas have a hazard of flooding during coastal storms. Coastal beach is on the barrier beach. It includes areas that have been highly urbanized. Extensive additions and alterations have been made to the original soils during construction in these areas.

The minor soils in this association are Pocomoke and Berryland soils and Muck. All of the minor soils have a seasonal high water table.

The soils in this association have severe limitations for urban use.

Descriptions of the Soils

In this section the soil series and mapping units in Atlantic County are described, and their use and management are discussed. Each soil series is described in detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

Figure 7.—**Extensive areas of Atsion, Pocomoke, and Berryland soils cleared for highbush blueberry production.**

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. Unless it is otherwise stated, the colors given in the descriptions are those of a moist soil. The profile described in the soil series is representative for mapping units in that series. If a given mapping unit has a profile in some ways different from the one described in the series, these differences are stated in the description of the mapping unit, or they are apparent in the name of the mapping unit. The description of each mapping unit contains suggestions on how the soil can be managed.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Coastal beach-Urban land complex and Fill land, for example, do not belong to a soil series but nevertheless are listed in alphabetic order along with the soil series.

Preceding the name of each mapping unit is a symbol that identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit are the capability unit and woodland suitability group in which the mapping unit has been placed. The page for the description of each mapping unit or other interpretive group can be learned by referring to the "Guide to Mapping Units" at the back of this survey.

The soils of Atlantic County have been joined with adjacent counties where possible. Some soils are extensive in one county but not extensive enough to retain in other counties. Fallsington soils were not retained in Atlantic County. Woodstown soils mapped in Camden, Gloucester, and Burlington Counties were subdivided to Woodstown and Hammonton soils. Lakeland, Leon, and St. Johns soils mapped in Camden and Gloucester Counties are called Evesboro, Atsion, and Berryland respectively in Atlantic County. Clayey substratum phases of Evesboro, Hammonton, and Klej soils mapped in Atlantic County were not mapped in most adjacent counties.

The acreage and proportionate extent of each mapping unit are shown in table 1. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*12*).[1]

[1] Italic numbers in parentheses refer to Literature Cited, p. 59.

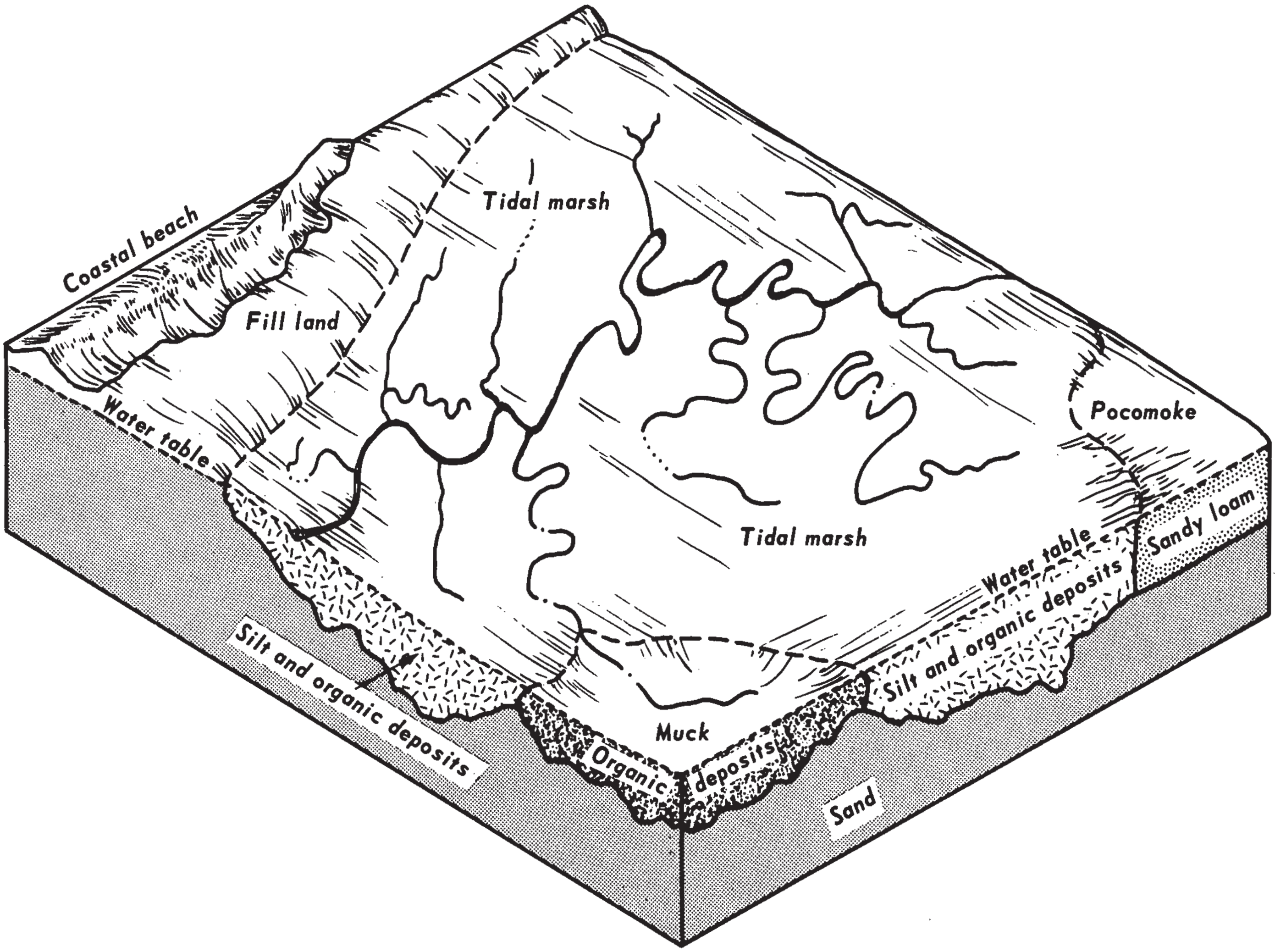

Figure 8.—**Typical soil pattern in Tidal marsh-Fill land-Coastal beach association.**

Atsion series

The Atsion series consists of nearly level, poorly drained, sandy soils that have a prominent, organically stained subsoil. These soils are on broad flats, in depressional areas, and in narrow drainageways. They occupy low positions on the landscape.

In a representative profile in a wooded area the surface layer is black sand 5 inches thick. The subsurface layer is light-gray sand 12 inches thick. The subsoil is 20 inches thick. The upper 7 inches is loose, dark-brown sand that is weakly cemented. The lower 13 inches is grayish-brown sand. The substratum between depths of 37 and 60 inches is grayish-brown sand.

These soils have low natural fertility and moderate content of organic matter. Added fertilizers leach readily. Unless limed, Atsion soils are extremely acid in the surface layer and very strongly acid in the subsoil. Permeability is moderately rapid or rapid. Where the soils have been drained, they have a low available water capacity. The high water table, however, provides additional water for plants.

The soils have a seasonal high water table at a depth of 0 to 1 foot. Water ponds in some areas. The soils are saturated for 6 to 8 months of the year when rainfall is normal. The water table starts to rise in October, reaches its peak at a depth of 0 to 1 foot about December, and drops to a depth of 2 to 4 feet by the end of July or August. In some areas that are drained for blueberries, the water level is 4 feet below the surface in summer. The water table drops to as low as 5 feet below the surface during extended dry periods. Where these soils are adjacent to the larger streams, they are commonly subject to flooding.

These soils have a slight hazard of water erosion and soil blowing in newly cleared areas. Since the soils are nearly level and in low positions, they receive runoff from the slopes above.

Natural vegetation consists mostly of pitch pine, blackgum, a few red maples, and a dense understory of highbush blueberry, sheep laurel, sweet pepperbush, gallberry, and greenbrier. Large areas of Atsion soil have been cleared for blueberry production, but most areas are still wooded. When drained, the soils are suited to blueberries (fig. 9), cranberries, and limited

TABLE 1.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent
Atsion sand	28,800	7.9
Aura loamy sand, 0 to 5 percent slopes	4,000	1.1
Aura sandy loam, 0 to 2 percent slopes	2,670	.7
Aura sandy loam, 2 to 5 percent slopes	14,200	3.9
Aura soils, ironstone variant, 0 to 5 percent slopes	550	.1
Berryland sand	12,200	3.3
Berryland sand, flooded	1,530	.4
Coastal beach-Urban land complex	2,940	.8
Downer loamy sand, 0 to 5 percent slopes	61,200	16.8
Downer sandy loam, 0 to 2 percent slopes	1,360	.4
Evesboro sand, 0 to 5 percent slopes	16,000	4.4
Evesboro sand, clayey substratum, 0 to 5 percent slopes	680	.2
Fill land	3,210	.9
Fill land over Tidal marsh	6,750	1.9
Fort Mott sand, 0 to 5 percent slopes	5,000	1.4
Hammonton loamy sand, 0 to 3 percent slopes	11,900	3.3
Hammonton loamy sand, clayey substratum, 0 to 2 percent slopes	1,240	.3
Hammonton sandy loam, 0 to 2 percent slopes	4,850	1.3
Hammonton sandy loam, clayey substratum, 0 to 2 percent slopes	660	.2
Klej loamy sand, 0 to 3 percent slopes	24,300	6.7
Klej loamy sand, clayey substratum, 0 to 3 percent slopes	5,550	1.5
Lakehurst sand, 0 to 3 percent slopes	17,200	4.7
Lakewood sand, 0 to 5 percent slopes	11,500	3.2
Lakewood sand, 5 to 10 percent slopes	480	.1
Matawan sandy loam, 0 to 5 percent slopes	2,230	.6
Muck	25,200	6.9
Pocomoke sandy loam	22,700	6.2
Sassafras sandy loam, 0 to 2 percent slopes	9,100	2.5
Sassafras sandy loam, 2 to 5 percent slopes	13,700	3.8
Tidal marsh, deep	36,700	10.1
Tidal marsh, moderately deep	4,300	1.2
Tidal marsh, shallow	1,490	.4
Woodstown sandy loam, 0 to 2 percent slopes	5,350	1.5
Areas not covered by soil symbols:		
Made land, sanitary landfill	280	.1
Pits, sand, gravel, borrow material, and clay	3,700	1.0
Water (less than 40 acres)	704	.2
Total	364,224	100.0

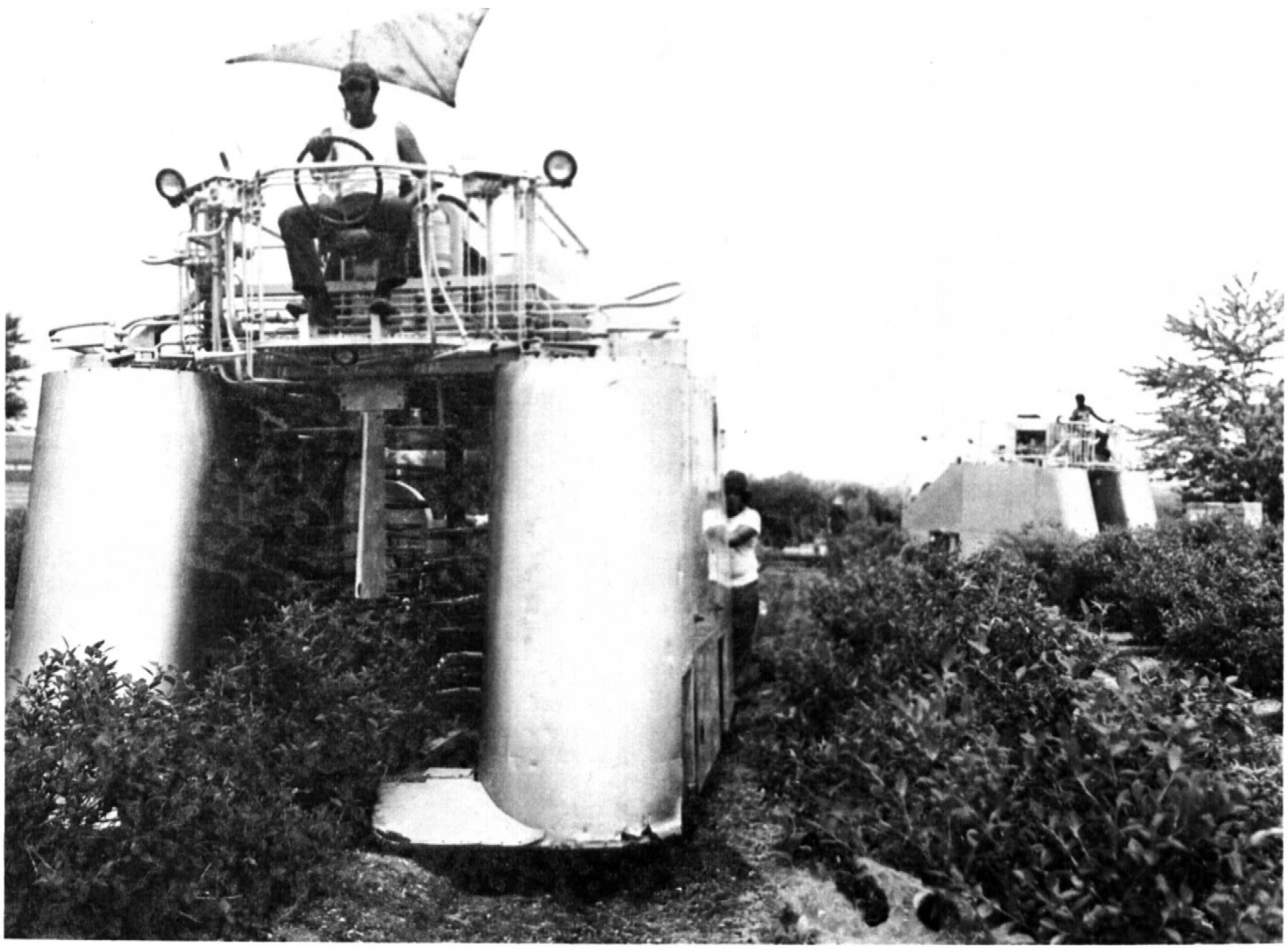

***Figure 9.*—Atsion soils need to be drained enough to prevent heavy highbush blueberry pickers such as this one from bogging down.**

summer vegetable production. The seasonal high water table imposes severe limitations for many uses. Where lower elevations are nearby, these soils can be drained enough to lower the water table.

Representative profile of Atsion sand, in a wooded area in Mullica Township, 2 miles south of Pleasant Mills on County Road 23, 200 feet east of road:

A1—0 to 5 inches, black (10YR 2/1) sand; very weak, medium, granular structure; very friable; many roots; extremely acid; abrupt, wavy boundary.

A2—5 to 17 inches, light gray (10YR 6/1) sand; single grained; loose; common roots; extremely acid; clear, smooth boundary.

B2h—17 to 24 inches, dark brown (7.5YR 3/2) sand; massive; dominantly loose, but firm in 40 percent of the horizon; weakly cemented; few roots; very strongly acid; clear, smooth boundary.

B3—24 to 37 inches, grayish brown (10YR 5/2) sand; single grained; loose; very strongly acid; clear, smooth boundary.

C—37 to 60 inches, grayish brown (10YR 5/2) sand; single grained; loose; very strongly acid.

The solum ranges from 20 to 40 inches in thickness. Depth to the Bh horizon ranges from 16 to 24 inches. In some profiles additional Bh horizons are at greater depths. Gravel is generally absent, but in some profiles it makes up as much as 10 percent of the C horizon.

The A1 horizon ranges from 4 to 6 inches in thickness. Hue is 2.5Y or 10YR, value is 2 or 3, and chroma is 0 or 1. The Bh horizon ranges from 4 to 8 inches in thickness. Hue is 7.5YR to 5YR, value is 2 or 3, and chroma is 2 or 3. The material in the Bh horizon is firm to loose, but it is dominantly loose. It becomes firmer when the soil is drained and dries out. In the C horizon hue is 10YR, value is 5 to 7, and chroma is 1 or 2.

Atsion soils are near areas of Berryland, Lakehurst, Klej, and Pocomoke soils and areas of Muck. They have neither the thick, black A horizon typical of Berryland soils nor the yellowish-brown B horizon typical of Klej and Lakehurst soils. They do not have the 16 inches or more of organic material typical of Muck. They have a coarser textured solum than Pocomoke soils.

Ac—Atsion sand. This soil is nearly level to depressional. Most areas are large and have irregular shapes, but some areas along small streams are long and narrow. In some areas this soil has a clayey substratum, dominantly below a depth of 40 inches.

Included with this soil in mapping are areas of soils that have a surface layer of loamy sand. Also included are areas of Lakehurst soils in higher positions. In very low positions, areas of Berryland and Pocomoke soils and of Muck are included.

Wetness is the main limitation to the use of this soil. Most cleared areas are used for growing blueberries or cranberries or for limited vegetable production. Current blueberry cultural practices include land smoothing, drainage, and controlled water tables. Irrigation is necessary during extended dry periods. The soil has good sites for ground-water ponds, and it is well suited to this use. Capability unit Vw-26; woodland suitability group 3w1.

Aura Series

The Aura series consists of nearly level or gently sloping, well drained, loamy soils that have firm gravelly sandy clay loam in the lower part of the subsoil. These soils are on the highest hilltops and divides in the landscape. They are underlain by thick, crossbedded sand or gravel deposits.

In a representative profile in a wooded area the surface layer is dark grayish-brown sandy loam 1 inch thick. The subsurface layer is pale-brown and yellowish-brown sandy loam 11 inches thick. The subsoil is 36 inches thick. The upper 13 inches of it is friable, strong-brown, gravelly sandy clay loam. The lower 23 inches is firm, yellowish-red gravelly sandy clay loam. The substratum is friable, yellowish-red loamy sand to a depth of 56 inches and loose, strong-brown gravelly sand to a depth of 72 inches.

These soils have medium natural fertility and moderate content of organic matter. Unless limed, Aura soils are extremely acid in the surface layer and very strongly acid in the subsoil. Permeability is generally moderately slow or moderate, but these soils pack readily when they are farmed intensively, and in places the plow layer is slowly permeable. The soils have a moderate available water capacity.

The soils have a seasonal high water table at a depth of more than 5 feet. The lower part of the subsoil is gravelly sandy clay loam that becomes firm or very firm when dry and restricts root growth. Few roots penetrate this horizon. Depth to the restricting layer ranges from 20 to 30 inches and averages about 26 inches. This horizon is so deep that it cannot be easily broken by equipment that is readily available in the area.

Those Aura soils that have a surface layer of loamy sand have a slight hazard of soil blowing and erosion; those that have a surface layer of sandy loam have a slight to moderate hazard of erosion. Aura soils are easily worked.

Most areas of Aura soils are wooded. Natural vegetation consists mostly of black, scarlet, and chestnut oaks; a few pines; and an understory mainly of laurel, sassafras, and lowbush blueberry. Scrub oak, blackjack oak, and pitch pine are common where forest fires have been severe. Some areas of Aura soils have been cleared and planted to fruit trees, vegetables, and other crops. Irrigation is common where high-value crops are grown. Aura soils are a good source of sand and gravel, and many sand and gravel pits are in areas of these soils.

Representative profile of Aura sandy loam, 2 to 5 percent slopes, in a wooded area in Egg Harbor Township, 1/4 mile southeast of the circle for the National Aviation Facilities Experimental Center on County Road 46, 200 feet north of road:

A1—0 to 1 inch, dark grayish brown (10YR 4/2) sandy loam; weak, medium, granular structure; very friable; many roots; 10 percent quartzose pebbles; extremely acid; abrupt, smooth boundary.

A2—1 to 3 inches, pale brown (10YR 6/3) sandy loam; weak, medium, granular structure; very friable; common roots; 10 percent quartzose pebbles; extremely acid; abrupt, smooth boundary.

A'2—3 to 12 inches, yellowish brown (10YR 5/6) sandy loam; weak, medium, subangular blocky structure; friable; common roots; 10 percent quartzose pebbles; some clay bridges; very strongly acid; clear, smooth boundary.

B2t—12 to 25 inches, strong brown (7.5YR 5/6) gravelly sandy clay loam; weak, medium, subangular blocky structure; friable; few fine roots; medium, continuous clay films on faces of peds; 20 percent quartzose pebbles; very strongly acid; clear, smooth boundary.

IIB22t—25 to 48 inches, yellowish red (5YR 5/6) gravelly sandy clay loam; massive; firm; 20 percent quartzose pebbles; sand grains bridged with clay; very strongly acid; clear, smooth boundary.

IIC1—48 to 56 inches, yellowish red (5YR 5/6) loamy sand; massive; friable; very strongly acid; clear, smooth boundary.

IIC2—56 to 72 inches, strong brown (7.5YR 5/6) gravelly sand; single grained; loose; 40 percent rounded quartzose pebbles; very strongly acid.

The solum ranges from 36 to 60 inches in thickness. Depth to the firm, redder part of the B horizon ranges from 20 to 30 inches and averages about 26 inches. The A and B horizons are about 10 to 20 percent rounded quartzose gravel, and as much as 40 percent of the C horizon in some profiles is this same material.

The A horizon is sandy loam or loamy sand. The A1 horizon ranges from 1 to 3 inches in thickness. It is dark grayish brown (10YR 4/2), very dark grayish brown (10YR 3/2), or brown (7.5YR 4/2). In the B horizon matrix colors range from yellowish brown (10YR 5/6) to strong brown (7.5YR 5/6). The B horizon is friable to very friable loam, sandy clay loam, or their gravelly analogs. In the lower part of the B horizon, matrix colors range from yellowish red (5YR 5/8) to reddish brown (2.5YR 4/4). This part of the B horizon is sandy clay loam, sandy clay, or their gravelly analogs. This material is moderately firm to extremely firm when moist and very hard to extremely hard when dry. The C horizon is friable to firm, stratified sand, loamy sand, sandy loam, sandy clay loam, or their gravelly analogs. Hue ranges from 10 YR to 5YR in this horizon, value is 5 or 6, and chroma is 6 or 8.

Aura soils are near areas of Sassafras, Woodstown, Downer, Hammonton, and Matawan soils. They have a B horizon that is firmer than the B horizon in Sassafras soils. Aura soils are firmer in the lower part of the B horizon than Woodstown soils, and do not have the low-chroma mottles that are common in the Woodstown soils. Aura soils have a finer textured and firmer B horizon than Downer and Hammonton soils. They do not have the low-chroma mottles that are common in Matawan soils.

AmB—Aura loamy sand, 0 to 5 percent slopes. This soil has a profile similar to the one described as representative of the series. The surface layer of this soil is loamy sand, however, and the subsoil is not so firm as the one in the representative profile. This soil has nearly level or gentle, slightly convex slopes. In some large areas the soil is nearly level in the center of the areas and gently sloping near the edges. Included in mapping are areas of Downer and Fort Mott soils.

Most areas of this soil are wooded. Some have been cleared and are used for growing fruit trees or vegetables. This soil is suited to fruits and vegetables. The moderately deep rooting zone is the main limitation to the use of this soil for crops. Irrigation is necessary for high-value crops. Soil blowing can be controlled by the use of cover crops or privet windbreaks. Capability unit IIIs–10; woodland suitability group 3o1.

ArA—Aura sandy loam, 0 to 2 percent slopes. This soil is similar to the one described as representative of the series, but it is nearly level. It is on the tops of low hills.

Included with this soil in mapping are small narrow bands of gently sloping Aura sandy loam near the outer edges of the mapped areas. Areas of Aura soils that have a gravelly surface layer are indicated on the map by gravel symbols. They are not so well suited to small vegetable crops as this soil. Small areas of soils that contain iron-cemented sandstone are indicated on the map by stone symbols. Also included are areas of Woodstown and Matawan soils in narrow drainageways and small depressional areas and some areas of Sassafras soils. The Matawan and Woodstown soils generally need drainage in cultivated areas.

This soil is well suited to growing fruits and vegetables. The moderately deep rooting zone is the main limitation to the use of this soil for farming. When the soil is cleared and used for fruit and vegetable farming, it has a slight hazard of erosion. Returning crop residue to the soil and using cover crops increase the content of organic matter. Irrigation is necessary for high-value crops during periods of little rainfall. Capability unit IIs–9; woodland suitability group 3o1.

ArB—Aura sandy loam, 2 to 5 percent slopes. This soil has the profile described as representative of the series. It is gently sloping and is on convex side slopes and broad ridgetops.

Included with this soil in mapping are moderately well drained Woodstown and Matawan soils in small depressional areas. Also included are small areas of Sassafras soils. Areas of Aura soils that have a gravelly surface layer are indicated on the map by gravel symbols. Small areas of soils that contain ironstone are indicated on the map by stone symbols.

This soil is well suited to growing fruits and vegetables. It has a moderate hazard of erosion. Runoff is medium in areas of intense cultivation and where the soils are compacted. Some cultivated areas have gullies in places. Crop production is limited by the moderately deep rooting zone; few roots extend a depth of 25 inches into the firm lower layer of the subsoil. Cover crops are used to increase the content of organic matter and available water capacity and reduce compaction. Erosion-control practices are needed in cultivated areas. Irrigation is necessary for high-value crops. Capability unit IIs–9; woodland suitability group 3o1.

Aura Variant

The Aura variants consist of gently sloping, well-drained soils on knolls and hilltops, generally at the highest elevations in the county.

In a representative profile in a cultivated area the surface layer is brown loamy sand 10 inches thick. It contains small amounts of quartzose pebbles and ironstone fragments. The subsoil is 26 inches thick. The upper 14 inches is yellow sandy loam that is 5 percent quartzose gravel and 10 percent ironstone fragments. The lower 12 inches is brownish-yellow gravelly sandy clay loam that is about 20 percent ironstone fragments and 5 percent rounded quartzose pebbles. The substratum, between depths of 36 and 60 inches, is strong-brown sandy loam that is about 40 percent ironstone. The ironstone fragments are 3 to 12 inches long and ½ inch to 6 inches thick.

The soils have medium natural fertility and low content of organic matter. Unless limed, Aura variant soils are extremely acid in the surface layer and strongly acid or very strongly acid in the subsoil. Permeability is moderately slow or moderate, and available water capacity is moderate. The water table is below a depth of 5 feet.

The lower part of the subsoil is firm and becomes hard when dry. It is firm enough to limit root pene-

tration. Ironstone fragments interfere with tillage operations and plant growth.

Most areas are wooded. Natural vegetation consists mostly of black, scarlet, and chestnut oaks; a few pines; and an understory of laurel, sassafras, and lowbush blueberry. Some areas of this soil have been cleared so that fruit trees and vegetables can be grown. Irrigation is common where high-value crops are grown. In places the soils have been extensively quarried for building stones. As a result, the many pits in these areas have left a rough surface.

Representative profile of Aura loamy sand, ironstone variant, 0 to 5 percent slopes, in a cultivated area in Hammonton Township, northwest of 8th Street on second road, 2/10 mile southwest along a field road to top of hill:

Ap—0 to 10 inches, brown (10YR 4/3) loamy sand; weak, medium, granular structure; very friable; 5 percent rounded quartzose pebbles and ironstone fragments, ½ inch to 6 inches long; strongly acid; clear, smooth boundary.

B1—10 to 24 inches, yellow (10YR 7/6) sandy loam; weak, medium, subangular blocky structure; very friable; 5 percent rounded quartzose pebbles and 10 percent indurated ironstone fragments, 1 to 6 inches long; strongly acid; gradual, wavy boundary.

B2t—24 to 36 inches, brownish yellow (10YR 6/8) gravelly sandy clay loam; moderate, medium, subangular blocky structure; firm; clay films on faces of peds and lining pebble niches; 5 percent rounded quartzose pebbles and 20 percent angular and subangular indurated ironstone fragments, 3 to 12 inches long; very strongly acid; gradual, wavy boundary.

C—36 to 60 inches, strong brown (7.5YR 5/8) sandy loam; weak, medium, subangular blocky structure; friable; approximately 40 percent indurated ironstone fragments, 3 to 12 inches long and ½ inch to 6 inches thick; very strongly acid.

The solum ranges from 24 to 48 inches in thickness. Depth to the lower part of the B horizon ranges from 18 to 40 inches. Ironstone makes up about 5 percent of the A horizon and as much as 75 percent of the C horizon.

The A horizon ranges from sandy loam to loamy sand. The A1 horizon is dark grayish brown (10YR 4/2), very dark grayish brown (10YR 3/2), or brown (7.5YR 4/2). The upper part of the B horizon ranges from yellow (10YR 7/6) to yellowish brown (10YR 5/8). It is friable or very friable loamy sand, sandy loam, or the gravelly analogs of these materials. The B2 horizon ranges from yellowish brown (10YR 5/8) to yellow (10YR 7/6) sandy loam to sandy clay or their gravelly analogs. The B2 horizon is dominantly sandy clay loam. It is as much as 40 percent ironstone fragments in some profiles. These fragments range from 3 to 24 inches in length and from ½ inch to 6 inches in thickness. The C horizon is yellow (10YR 7/6) to strong-brown (7.5YR 5/8) sand to sandy clay. The dominant texture, however, is sandy loam. The C horizon is as much as 75 percent ironstone fragments in some profiles. These fragments are very hard and are about 2 inches thick. Some, however, are 2 feet or more thick.

Aura variants are near areas of Sassafras and normal Aura soils. Unlike Sassafras and the normal Aura soils, the Aura variants contain ironstone fragments.

AvB—Aura soils, ironstone variant, 0 to 5 percent slopes. This soil has a varying content of ironstone fragments. It is not well suited to farming, but where fragments are scarce and are not close to the surface it can be used for growing vegetables. Depth of the rooting zone is limited by the firm lower part of the subsoil. Where the content of ironstone fragments is high, excavation is difficult. Most wooded areas have pits that have been dug to quarry stones for use in foundations of buildings. Capability unit IVs–10; woodland suitability group 3o1.

Berryland Series

The Berryland series consists of nearly level, very poorly drained, sandy soils that have an organically stained subsoil. These soils are in wide depressional areas and on broad lowland flats. They occupy low positions on the landscape.

In a representative profile in a wooded area the surface layer is black sand 10 inches thick. The subsurface layer is pinkish-gray sand 5 inches thick. The subsoil is 17 inches thick. The upper 7 inches is very dark grayish-brown loamy sand, and the lower 10 inches is light brownish-gray sand. The substratum between depths of 32 and 64 inches is light brownish-gray sand.

These soils have low natural fertility and high content of organic matter. Unless limed, Berryland soils are extremely acid in the surface layer and very strongly acid below. Permeability is moderately rapid. Where the soils have been drained, they have low available water capacity. The high water table, however, provides additional water for plants.

A seasonal high water table is at the surface of these soils. Water ponds in some areas. The soils are saturated for 7 to 9 months of the year when rainfall is normal. The water table starts to rise in September, reaches its peak in November, and generally starts to drop late in May. It only drops to a depth of about 2 feet by the end of July or August. Saturated Berryland soils have low strength. Where the soils are adjacent to larger streams, they are subject to frequent flooding.

These soils have slight hazards of water erosion and soil blowing in cleared areas. Since the soils are nearly level and are in low positions, they receive runoff from the slopes above.

Natural vegetation consists mostly of pitch pine; some scattered Atlantic white cedar, blackgum, red maple, and sweetgum; and a dense understory of holly, sweet pepperbush, highbush blueberry, and gallberry. Large areas of Berryland soils have been cleared and planted for blueberry production. Land smoothing is necessary to prevent ponding and to prepare the fields for tillage and harvesters. Artificial drainage is established before planting. The water level is controlled at a depth of about 2 feet by use of ditches and various types of irrigation. When drained, the soils are suited to blueberry and cranberry production. The high water table imposes severe limitations for many community development uses.

Representative profile of Berryland sand, in a wooded area in Mullica Township, ¾ mile west of Pleasant Mills on County Road 542, 400 feet south of road:

A1—0 to 10 inches, black (10YR 2/1) sand; weak, medium, granular structure; very friable; 5 percent quartzose pebbles; extremely acid; clear, smooth boundary.

A2g—10 to 15 inches, pinkish gray (7.5YR 6/2) sand; single grained; loose; 10 percent quartzose peb-

bles; very strongly acid; abrupt, smooth boundary.

B2h—15 to 22 inches, very dark grayish brown (10YR 3/2) loamy sand; massive; slightly firm; weakly cemented in less than half of the horizon; 5 percent quartzose pebbles; very strongly acid; abrupt, smooth boundary.

B3g—22 to 32 inches, light brownish gray (10YR 6/2) sand; single grained; loose; few roots; 10 percent quartzose pebbles; very strongly acid; clear, smooth boundary.

Cg—32 to 64 inches, light brownish gray (10YR 6/2) sand; single grained; loose; 10 percent quartzose pebbles; very strongly acid.

The solum ranges from 28 to 40 inches in thickness. Depth to the Bh horizon ranges from 10 to 16 inches. In some profiles additional Bh horizons are at greater depths. The solum is less than 5 percent to as much as 10 percent gravel. In some profiles the C horizon is as much as 20 percent quartzose gravel.

In the A1 horizon value is 2 or 3, and chroma is 1 or 2. The A2 horizon is absent in many profiles, but where it is present, value is 5 or 6. The Bh horizon is loamy sand or sand that ranges from loose to very firm within a few feet and becomes harder when dry. Hue is 10YR to 5YR, value is 2 or 3, and chroma is 1 or 2 in this horizon. In most places cementation is caused by organic matter, but iron-cemented sandstone also forms in places. In the C horizon value is 4 to 6, and chroma is 1 to 3. In places this horizon has a strong odor of hydrogen sulfide.

Berryland soils are near areas of Atsion, Pocomoke, Lakehurst, and Klej soils and areas of Muck. They have a darker and thicker A1 or Ap horizon than Atsion soils. Berryland soils have a thicker and darker A horizon than Lakehurst or Klej soils. They have neither the yellowish-brown B horizon that is common in the Lakehurst and Klej soils nor the dominantly organic surface layer 16 inches or more thick typical of Muck. They do not have the sandy loam B horizon typical of Pocomoke soils.

Bp—Berryland sand. This nearly level soil has the profile described as representative of the series. Most areas are large and have irregular shapes. Some areas that are adjacent to streams are long and narrow. Included in mapping are Atsion, Lakehurst, and Pocomoke soils; Berryland sand, flooded; and Muck.

Most areas of this soil are wooded. Cleared and drained areas are used for growing blueberries or cranberries. Current management practices for growing blueberries or cranberries include drainage, controlling the water table, and land smoothing. Flooding is needed for growing cranberries. Irrigation is necessary during extended dry periods. This soil is well suited to ground-water ponds. Capability unit Vw–26; woodland suitability group 3w1.

BS—Berryland sand, flooded. This nearly level soil has a profile similar to the one described as representative of the series, but the typical firm, organically stained subsoil is not as consistently developed. The surface layer is black, dark brown, or very dark gray. In places it is mucky, generally to a depth of less than 16 inches. The underlying sand is grayish brown and in places has a considerable content of rounded quartzose gravel. This soil is near Atsion and Lakehurst soils and areas of Muck. Included in mapping are areas of all these soils.

This soil is subject to frequent flooding, because it is adjacent to the meandering perennial streams and rivers. Stream channels are shallow in most places, and floodwaters spread readily to this soil where they deposit much debris and additional soil particles. Most areas of this soil are subject to annual flooding, but about 5 to 10 percent of the areas are subject to flooding every 5 to 10 years.

Nearly all areas of this soil are wooded. Native vegetation is quite variable. Nearly pure stands of Atlantic white cedar grow where the surface layer is mucky. Where the surface layer is sandy, the vegetation includes pitch pine, blackgum, sweetgum, and a dense understory of holly, highbush blueberry, greenbrier, gallberry, and sweet pepperbush. This soil is suited to dug ponds, but there is a hazard of overflow. It has a constantly high water table that is controlled by the adjacent streams. The water table is at the surface in winter and drops only about 1 foot in summer, except during periods of extreme drought. Capability unit Vw–26; woodland suitability group 3w1.

Coastal Beach-Urban Land Complex

Cu—Coastal beach-Urban land Complex. This mapping unit consists of nearly level or gently sloping beaches, adjacent gently sloping or sloping dunes, and areas developed for urban uses. The dunes are at low elevation and are subject to tidal flooding or storm flooding and constant spraying by salty water. The urban land contains much fill material.

The thick deposits of sand have no profile development. The beach areas have small amounts of fine to medium gravel. The dunes are mostly fine sand that contain little gravel, clay, or silt.

Natural vegetation includes beachgrass, dune panicgrass, seaside goldenrod, and sea rocket. Trees and shrubs include eastern redcedar, American holly, bayberry, wild cherry, chokecherry, beach plum, flameleaf sumac, and groundsel. These plants help to stabilize the sands and aid dune buildup by trapping windblown sands. When the vegetation is disturbed or removed, the dunes tend to disappear with the wind and new ones form elsewhere.

About 80 percent of the acreage of this mapping unit is used for residential areas or resorts. About 30 percent of this area is covered by buildings, streets, and parking lots. Approximately 10 percent of the acreage of this mapping unit is covered by natural vegetation. Most areas have severe limitations for most permanent structures, including homes, roads, utility lines, and onsite septic systems. The reason for this is the high susceptibility to flooding by extremely high tides produced by coastal storms. Droughtiness, infertility, and in places salt spraying prevent the growth of many species of upland plants commonly found on the mainland. Capability unit VIIIs–31; woodland suitability group not assigned.

Downer Series

The Downer series consists of well-drained, nearly level to gently sloping, sandy or loamy soils. These soils occupy high positions on the landscape.

In a representative profile in a wooded area the surface layer is dark grayish-brown loamy sand 7 inches thick. The subsurface layer is yellowish-brown loamy sand 10 inches thick. The subsoil is yellowish-brown sandy loam 16 inches thick. Between depths of

33 and 60 inches the substratum is strong-brown loamy sand and yellowish-brown sand.

These soils have medium natural fertility and low content of organic matter. Because added fertilizers leach readily, raising the level of fertility is difficult. Unless limed, Downer soils are extremely acid or very strongly acid in the surface layer and strongly acid in the subsoil. Permeability is moderate or moderately rapid, but the plow layer in intensively cultivated areas has slower permeability where it has been compacted. These soils have a moderate available water capacity.

The soils have a seasonal high water table at a depth of 4 feet or below. The soils warm early and are easily worked.

Natural vegetation consists of white, black, and chestnut oak; hickory; scattered pitch, shortleaf, and Virginia pine; and an understory of sassafras, holly, and lowbush blueberry. Some areas have been cleared so that fruit trees and vegetables can be grown, but most areas are still wooded. Irrigated sweet corn and other early vegetables are commonly grown. These soils have slight limitations for homesites and most other community development uses.

Representative profile of Downer loamy sand, 0 to 5 percent slopes, in a wooded area, 200 feet north of Oakcrest High School in Hamilton Township:

A1—0 to 7 inches, dark grayish brown (10YR 4/2) loamy sand; moderate, fine, granular structure; very friable; many roots; few rounded quartzose pebbles; very strongly acid; abrupt, smooth boundary.

A2—7 to 17 inches, yellowish brown (10YR 5/6) loamy sand; weak, fine, granular structure; very friable; many roots; very strongly acid; clear, smooth boundary.

B2t—17 to 33 inches, yellowish brown (10YR 5/6) sandy loam; weak, fine and medium, subangular blocky structure; very friable; common roots; clay bridges between sand grains; strongly acid; clear, smooth boundary.

C1—33 to 40 inches, strong brown (7.5YR 5/6) loamy sand; single grained; loose; few roots; strongly acid; clear, smooth boundary.

C2—40 to 60 inches, yellowish brown (10YR 5/6) sand; single grained; loose; few roots; strongly acid.

The solum ranges from 20 to 38 inches in thickness and averages about 30 inches. In some areas quartzose gravel makes up from 5 percent of the A and B horizons to as much as 20 percent of some parts of the C horizon.

The A1 horizon is grayish brown (10YR 5/2) or dark grayish brown (10YR 4/2). A thin, bleached A2 horizon is in some profiles. The B horizon is sandy loam or, rarely, light sandy clay loam in thin horizons. The Bt horizon ranges from yellowish brown (10YR 5/8) to dark brown (7.5YR 4/4). Some profiles have thin layers of loamy sand. The C horizon ranges from brownish yellow (10YR 6/6) to strong brown (7.5YR 5/6). It is dominantly sand or loamy sand, but thin sandy loam layers are in this stratified material in most profiles.

Downer soils are near areas of Hammonton, Sassafras, Aura, Klej, Evesboro, Fort Mott, Woodstown, and Lakehurst soils. They have neither the mottled B horizon typical of Hammonton, Klej, and Woodstown soils nor the moderately fine textured B horizon typical of Aura and Sassafras soils. They have a sandy loam B horizon that Evesboro soils do not have. Downer soils have neither the thick A horizon typical of Fort Mott soils nor the thick, bleached A2 horizon typical of Lakehurst soils.

DoA—Downer loamy sand, 0 to 5 percent slopes. This nearly level or gently sloping soil has the profile described as representative of the series. Most areas are large and have irregular shapes.

Included with this soil in mapping are areas of Hammonton, Klej, and Lakehurst soils in slightly lower positions; areas of Evesboro, Sassafras, and Aura soils in higher positions; and areas of Downer sandy loam. Also included are very small depressional areas of poorly drained and very poorly drained soils that are indicated on the map by a wet spot symbol; small areas of soils that have slopes of 5 percent or more; and, in places, areas of well-drained soils that have a gravelly surface layer. These gravelly areas are indicated on the map by gravel symbols.

Most areas of this soil are wooded. Some have been cleared and are used for growing fruit and vegetables. Droughtiness is the main limitation to the use of this soil. Cover crops help to maintain the content of organic matter. Large, exposed areas of this soil are subject to soil blowing, and privet windbreak hedges are generally used to control it. Capability unit IIs–6; woodland suitability group 3o1.

DsA—Downer sandy loam, 0 to 2 percent slopes. This nearly level soil has a profile similar to the one described as representative of the series, but the surface layer is sandy loam.

Included with this soil in mapping are areas of Downer soils that have slopes of more than 2 percent. The soils in these areas have a more severe hazard of erosion than this soil. Also included in places are areas of Aura and Sassafras soils on small, rounded knolls and areas of moderately well drained Hammonton soils in slight depressions.

This soil is used for growing vegetables and fruit common to the area. It is well suited to this use but has a slight hazard of erosion. Cover crops help to maintain the content of organic matter. Capability unit I–5; woodland suitability group 3o1.

Evesboro Series

The Evesboro series consists of nearly level or gently sloping, excessively drained, loose, sandy soils. These soils occupy high positions on the landscape.

In a representative profile in a wooded area the surface layer is loose, grayish-brown sand 3 inches thick. The subsurface layer is loose, pale-brown sand 10 inches thick. The subsoil is loose, brownish-yellow sand 23 inches thick. The substratum, between depths of 36 and 60 inches, is loose, yellow sand.

These soils have low natural fertility and low content of organic matter. Added fertilizers leach readily. Unless limed, Evesboro soils are extremely acid or very strongly acid in the solum and very strongly acid or strongly acid in the substratum. Permeability is rapid in the solum but ranges from moderately rapid to slow in the substratum. The soils have low available water capacity. The seasonal high water table is at a depth of 5 feet or below. These soils have a hazard of soil blowing in cleared and cultivated areas. They warm early in spring and are easily worked.

Natural vegetation consists of black, white, and chestnut oak; Virginia, shortleaf, and pitch pine; and an understory of lowbush blueberry. Pitch pine, scrub oak, and blackjack oak are common in areas where wildfires have been severe. Pines generally seed naturally in cleared areas left idle. Most areas of these

soils are wooded. Many areas that were once cleared for farming have been abandoned. Generally the soils are too droughty for most crops. In areas where the soils are used for growing fruits and vegetables, frequent irrigation is necessary. These soils have limitations for urban uses that depend on the kind of material in the substratum.

Representative profile of Evesboro sand, 0 to 5 percent slopes, in a wooded area in Mullica Township, ½ mile northeast of old Amatol racetrack:

A1—0 to 3 inches, grayish brown (10YR 5/2) sand; single grained; loose; many roots; extremely acid; abrupt, smooth boundary.

A2—3 to 13 inches, pale brown (10YR 6/3) sand; single grained; loose; common roots; very strongly acid; clear, smooth boundary.

B—13 to 36 inches, brownish yellow (10YR 6/6) sand; single grained; loose; common roots; coatings on sand grains; very strongly acid; gradual, smooth boundary.

C—36 to 60 inches, yellow (10YR 7/6) sand that has thin, discontinuous layers of brown (7.5YR 5/4) sandy loam; single grained; loose; very strongly acid.

The solum ranges from 24 to 48 inches in thickness and averages about 40 inches. Rounded quartzose pebbles generally make up less than 5 percent of the solum, but in some profiles they make up as much as 10 percent. They make up as much as 20 percent of the C horizon. The profile is sand or loamy sand throughout.

In the A horizon hue is 10YR, value is 4 or 5, and chroma is 1 or 2. The A2 horizon has chroma of 2 or 3. In cultivated areas the A1 and A2 horizons and part of the B horizon are mixed by plowing. Where cultivated, the Ap horizon is grayish brown (10YR 5/2) or dark grayish brown (10YR 4/2). In the B horizon hue is 10YR, and value is 5 or 6. In the C horizon, hue is 10YR, and value is 6 or 7. Hue of the many thin strata in the C horizon is 7.5YR. The lower part of the C horizon has layers of sandy loam to clay.

Evesboro soils are near areas of Klej, Downer, Fort Mott, Lakehurst, and Lakewood soils. They have neither the mottled B horizon typical of Klej soils nor the sandy loam B horizon typical of Downer and Fort Mott soils. They do not have the thick, bleached A2 horizon typical of Lakehurst and Lakewood soils.

EvB—Evesboro sand, 0 to 5 percent slopes. This soil has the profile described as representative of the series. It is nearly level or gently sloping. Most areas are large and have irregular shapes.

Included with this soil in mapping are small areas of Lakewood soils and, in places, areas of Klej and Lakehurst soils in small depressions and narrow drainageways. The areas of Klej and Lakehurst soils generally need drainage if they are cultivated. Also included are small depressional areas of poorly drained soils, indicated on the map by wet spot symbols, and some very narrow areas of sloping to very steep soils adjacent to streams, indicated on the map by escarpment symbols. A few areas of Evesboro soils that have a clayey, slowly permeable substratum are also included.

Most cultivated areas of this soil are used for growing sweetpotatoes, peaches, grapes, and cantaloupes. Large exposed areas that have been cleared and farmed need protection from soil blowing. Protection is provided by cover crops and privet windbreak hedges (fig. 10). Frequent irrigation is necessary for satisfactory production of high-value crops. Cover crops are used to reduce the hazard of erosion. This soil has slight limitations to use for septic filter fields and has a hazard of ground-water pollution. Capability unit VIIs–8; woodland suitability group 4s1.

EwB—Evesboro sand, clayey substratum, 0 to 5 percent slopes. This soil has a profile similar to the one described as representative of the series, but it has a sandy clay or clay layer at least 12 inches thick at a depth of 40 to 60 inches. Permeability in the substratum is slow. In places in areas where the soil is gently sloping, water moves laterally over the clayey substratum.

Included with this soil in mapping are areas of Klej, clayey substratum, soils in small depressions. Drainage is generally necessary in these areas when the soil is farmed.

Limitations of this soil for septic filter fields are severe, because the substratum is slowly permeable. Droughtiness, low fertility, and the hazard of soil blowing are the main limitations to the use of this soil for crop production. Cover crops are used to control soil blowing and to maintain the content of organic matter. Capability unit IVs–8; woodland suitability group 3s1.

Fill Land

FL—Fill land. This land type consists of areas in the upland part of the county that have been filled in with several feet or more of material, mainly quartz sand and gravel. The National Aviation Facilities Experimental Center, shopping centers, schools, and other places where excavation and filling have disturbed most or all of the original characteristics of the soil profile are in the mapped areas.

In most areas this land type is low in natural fertility, has a very low content of organic matter, and has low available water capacity. Permeability in most places is rapid. If the fill contains much fine-textured material, however, available water capacity is higher and permeability is slower. The fill material is excessively drained in most places, but drainage is impeded where the sandy material has been placed over poorly drained and very poorly drained soils. Depth to the water table is quite variable, depending upon the depth in the original soil material and the thickness of the fill material.

Limitations for urban uses of Fill land are quite variable, depending upon the original soil and the thickness of fill material. Onsite investigation is needed to determine the suitability of each area. Not assigned to a capability unit or woodland suitability group.

Fill Land Over Tidal Marsh

FM—Fill land over Tidal marsh. This land type consists of Tidal marsh that has had several feet or more of sandy fill material deposited or pumped on it. In places the fill material was pumped from nearby streams in dredging operations. In other areas the material was trucked in. Most areas of this land type are subject to flooding from extremely high tides during coastal storms.

The fill material of this land type has low natural fertility and a very low content of organic matter. The soil material is excessively drained in most places.

Figure 10.—**This tall privet hedge helps to control soil blowing on Evesboro sand.**

The available water capacity is low in this land type, and permeability is rapid in areas where the fill material is 6 feet or more in thickness. Drainage is impeded and permeability is slower in areas where the fill material is less than 6 feet thick.

Limitations for most urban uses are severe because of the hazard of flooding. Methane and hydrogen sulfide gases form in most areas from the decaying underlying vegetation, and these gases tend to cause undesirable conditions if dwellings are constructed in these areas. Onsite investigation is needed to determine the suitability of each area. Not assigned to a capability unit or woodland suitability group.

Fort Mott Series

The Fort Mott series consists of well-drained, nearly level or gently sloping soils that have a thick, sandy surface layer and a finer textured subsoil. They occupy high positions on the landscape.

In a representative profile in a wooded area the surface layer is very dark grayish-brown sand 2 inches thick. The subsurface layer is brown sand and brownish-yellow loamy sand 23 inches thick. The subsoil is yellowish-brown sandy loam 16 inches thick. The substratum, between depths of 41 and 60 inches, is brownish-yellow gravelly loamy sand.

These soils have low natural fertility and low content of organic matter. Added fertilizers leach readily. Unless limed, Fort Mott soils are extremely acid in the surface layer and very strongly acid in the subsoil. Permeability is moderate or moderately rapid. The soils have moderate available water capacity, though it is low in the top 25 inches of the profile.

The soils have a water table at a depth of 5 feet or more. They have a slight hazard of water erosion and a severe hazard of soil blowing in large cultivated areas. Fort Mott soils warm early in spring and are easily worked.

Most areas of these soils are wooded. Natural vegetation in these areas consists of black, white, and chestnut oak; hickory; scattered pitch, shortleaf, and Virginia pine; and an understory of sassafras, holly, and lowbush blueberry. Cleared areas are used mainly for growing fruit trees and vegetables. Irrigated sweet corn and early vegetable crops generally grow well in these soils. These soils have slight limitations for homesites and severe limitations for recreational uses because of the severe hazard of dust.

Representative profile of Fort Mott sand, 0 to 5

percent slopes, in Hamilton Township near Dorothy; ½ mile east of Estell Avenue on 16th Street to the second road, 900 feet north in cleared property boundary around homesite, and 20 feet east of road:

O2—1 inch to 0, black (10YR 2/1) leaf mull; very strongly acid.
A1—0 to 2 inches, very dark grayish brown (10YR 3/2) sand; weak, medium, granular structure; very friable; many fine and medium roots; extremely acid; abrupt, smooth boundary.
A21—2 to 6 inches, brown (10YR 5/3) sand; single grained; loose; many fine and medium roots; extremely acid; abrupt, smooth boundary.
A22—6 to 25 inches, brownish yellow (10YR 6/6) loamy sand; single grained; loose; common fine roots; extremely acid; gradual, smooth boundary.
B2t—25 to 41 inches, yellowish brown (10YR 5/8) sandy loam; weak, medium, subangular blocky structure; very friable; few fine roots; thin, very patchy clay films; some clay bridges between sand grains; 10 percent rounded quartzose pebbles; very strongly acid; clear, smooth boundary.
C—41 to 60 inches, brownish yellow (10YR 6/8) gravelly loamy sand; single grained; loose; few roots; 20 percent rounded quartzose pebbles; very strongly acid.

The solum ranges from 40 to 60 inches in thickness. Depth to the B horizon ranges from 20 to 40 inches and averages about 26 inches. Gravel content is generally 5 percent or less, but in some profiles gravel makes up as much as 30 percent of the C horizon.

In the A1 hue is 10YR, value is 3 or 4, and chroma is 1 or 2. In the A2 horizon hue is 10YR, value is 5 or 6, and chroma is 3 to 6. The B horizon is sandy loam, sandy clay loam, or their gravelly analogs. Hue is 10YR in this horizon, value is 5 or 6, and chroma is 6 or 8.

Fort Mott soils are near Downer, Evesboro, Hammonton, Klej, and Sassafras soils. They have a thicker A horizon than Downer soils and a finer textured B horizon than the one typical of Evesboro soils. Fort Mott soils have neither the gray mottles typical of Klej and Hammonton soils nor the thick, sandy loam surface layer typical of Sassafras soils.

FrA—Fort Mott sand, 0 to 5 percent slopes. This soil is nearly level or gently sloping. Most areas are small and have irregular shapes.

Included with this soil in mapping are areas of Downer, Evesboro, Klej, and Lakehurst soils and areas of soils that have a surface layer of loamy sand. Also included are areas of moderately well drained soils that need drainage if they are used for cultivated crops. Included are areas of soils that have a gravelly surface layer. These areas of gravelly soils are indicated on the map by gravel symbols.

Most areas of this soil are wooded. A few areas have been cleared and are used for growing fruits and vegetables. Droughtiness is the main limitation to the use of this soil for crop production. Cover crops are used to control soil blowing and maintain the content of organic matter. Capability unit IIIs-6; woodland suitability group 3o1.

Hammonton Series

The Hammonton series consists of nearly level, moderately well drained and somewhat poorly drained soils. Most of these soils are moderately well drained. They are in depressional areas and on broad flats and occupy intermediate positions on the landscape.

In a representative profile in a cultivated area the surface layer is very dark grayish-brown loamy sand 8 inches thick. The subsurface layer is yellowish-brown loamy sand 10 inches thick. The subsoil, 18 inches thick, is yellowish-brown sandy loam that has light-gray and brownish-yellow mottles. The substratum, between depths of 36 and 60 inches, is mottled, brownish-yellow sand.

These soils have medium natural fertility and low or moderate content of organic matter. Unless limed, Hammonton soils are extremely acid in the surface layer and very strongly acid in the lower horizons. Permeability generally is moderate or moderately rapid, but it is slow in those soils that have a clayey substratum. The soils have a moderate available water capacity. The water table, however, provides additional water for plants.

The soils have a seasonal high water table at a depth of 1½ to 4 feet. During periods of normal rainfall, the water table starts to rise in October, reaches its peak by early January, starts to drop in April, and drops to a depth of 5 feet or below by June.

In places Hammonton soils receive runoff from slopes above. These soils have a slight hazard of water erosion and soil blowing in cleared and cultivated areas. They are easily worked by equipment, but tillage is generally delayed in spring because of wetness.

Natural vegetation consists of white, southern red, and black oak; pitch pine; and an understory of holly, laurel, sheep laurel, gallberry, lowbush blueberry, and greenbrier. Most areas of this soil are wooded, and most areas that have been cleared are used for growing fruits and vegetables. Where farmed, artificial drainage is generally necessary. Irrigation is necessary if high-value crops are grown. Hammonton soils must be deeply drained if they are to be used for septic fields or for houses that have basements.

Representative profile of Hammonton loamy sand, 0 to 3 percent slopes, in a cultivated field, ½ mile east of junction with Carl Road, 50 yards northeast of Aetna Road in Corbin City:

Ap—0 to 8 inches, very dark grayish brown (2.5Y 3/2) loamy sand, gray (N 6/0) dry; weak, medium, granular structure; very friable; many roots; very strongly acid; abrupt, smooth boundary.
A2—8 to 18 inches, yellowish brown (10YR 5/4) loamy sand; weak, fine, granular structure; very friable; many roots; very strongly acid; gradual, wavy boundary.
B2t—18 to 36 inches, yellowish brown (10YR 5/6) sandy loam; common, medium, distinct, light gray (5Y 7/2) and brownish yellow (10YR 6/8) mottles; weak, fine, subangular blocky structure; friable; common fine roots; less than 5 percent rounded quartzose pebbles; few patchy clay films on peds or lining pebble niches; clay bridges common in upper part, decreasing with depth; very strongly acid; gradual, wavy boundary.
IIC—36 to 60 inches, brownish yellow (10YR 6/6) sand that has few, medium, distinct, light gray (5Y 7/2) and brownish yellow (10YR 6/8) mottles; single grained; loose; few fine roots; 5 percent rounded quartzose pebbles; very strongly acid.

The solum ranges from 20 to 40 inches in thickness, but the average thickness is 26 inches. Coarse fragments are predominantly rounded quartzose gravel. They generally make up less than 10 percent of the solum, but they make up as much as 20 percent of some subhorizons of the solum. In some profiles gravel makes up as much as 40 percent of the C horizon, but the average is less than 10 percent.

In the A and Ap horizons hue is 5Y to 10YR, value is 3 or 4, and chroma is 0 to 3. In the A2 horizon hue is 2.5Y to 10YR, value is 4 to 6, and chroma is 4 to 6. The A horizon is loamy sand or sandy loam. In the B horizon hue is 2.5Y or 10YR, value is 4 to 6, and chroma is 3 to 6. Mottles that have chroma of 2 or less are less than 24 inches below the top of the Bt horizon. The B horizon is generally sandy loam, but thin horizons of sandy clay loam are in many profiles. In places the B1 and B3 horizons are loamy sand. The C horizon is stratified. Hue is 5Y to 10YR in this horizon, value is 5 to 8, and chroma is 2 to 6. This horizon is dominantly loamy sand or sand above a depth of 40 inches, but thin strata of sandy clay loam are present above this depth in many profiles. Below a depth of 40 inches the C horizon is sand to sandy clay or clay.

Hammonton soils are near areas of Downer, Sassafras, Woodstown, Evesboro, Klej, and Fort Mott soils. They do not have the sandy clay loam B horizon typical of Woodstown soils. Unlike Downer, Sassafras, Fort Mott, and Evesboro soils, Hammonton soils are mottled; unlike Klej soils, Hammonton soils have a B horizon of sandy loam.

HaA—Hammonton loamy sand, 0 to 3 percent slopes. This soil has the profile described as representative of the series. Included in mapping are areas of Klej, Downer, Fort Mott, Pocomoke, Atsion, and Lakehurst soils.

Most areas of this soil are wooded. This soil is suited to growing most fruit and vegetable crops when it is drained. Wetness is the main limitation of this soil in its natural condition. Where the soil is drained, droughtiness is a limitation during long dry periods. Winter cover crops and windbreak hedges are used to control soil blowing. Capability unit IIw–15; woodland suitability group 2o1.

HcA—Hammonton loamy sand, clayey substratum, 0 to 2 percent slopes. This soil has a clayey substratum, generally at a depth of 40 to 60 inches, but the profile is otherwise similar to the one described as representative of the series. The clayey layer is at least 12 inches thick. Included in mapping are areas of Downer, Fort Mott, Klej, Pocomoke, Atsion, and Lakehurst soils.

Wetness is the main limitation to the use of this soil for crop production. If this soil is drained, droughtiness is a limitation during long dry periods. Subsurface drains are used in places to lower the water table. Winter cover crops and windbreak hedges are used to control erosion where this soil is cleared and used for crops. Because of the clayey substratum, this soil has severe limitations for septic effluent disposal. If used as a site for a ground-water pond, the rate of recharge is slow where the clay substratum is thick. Capability unit IIw–15; woodland suitability group 2o1.

HmA—Hammonton sandy loam, 0 to 2 percent slopes. This soil has a profile similar to the one described as representative of the series, but its surface layer is sandy loam. Included in mapping are areas of Downer, Klej, Woodstown, Pocomoke, and Atsion soils.

Most areas of this soil are wooded. Some have been cleared and are used for growing crops. Wetness is the main limitation to the use of this soil for crop production. Subsurface drains are used to lower the water table. If this soil is drained, it is well suited to fruit and vegetable production. Winter cover crops are used to control erosion and to maintain the content of organic matter. Capability unit IIw–15; woodland suitability group 2o1.

HnA—Hammonton sandy loam, clayey substratum, 0 to 2 percent slopes. This soil has a profile similar to the one described as representative of the series, but it has a surface layer of sandy loam and a clayey substratum. The clayey substratum is at least 12 inches thick. It is at a depth of 40 to 60 inches. Included in mapping are areas of Downer, Klej, Woodstown, Pocomoke, and Atsion soils.

Wetness is the main limitation to the use of this soil. Subsurface drains have been used to reduce wetness. If this soil is drained, it is well suited to fruit and vegetable production. Winter cover crops are used to control erosion and to maintain the content of organic matter. Capability unit IIw–15; woodland suitability group 2o1.

Klej Series

The Klej series consists of deep, nearly level, moderately well drained and somewhat poorly drained, sandy soils. Most are moderately well drained. They occupy intermediate positions on the landscape. Unlike most soils in the county, Klej soils have approximately the same amount of clay in the subsoil as in the surface layer.

In a representative profile in a wooded area the surface layer is dark grayish-brown loamy sand 2 inches thick over pale-brown loamy sand 8 inches thick. The subsoil is 26 inches thick. It is yellowish-brown and brownish-yellow loamy sand and has brownish-gray mottles below a depth of 24 inches. Between depths of 36 and 52 inches the substratum is brownish-yellow sand that has light-gray mottles; between depth of 52 and 60 inches it is light-gray sand that has pale-brown mottles.

These soils have low natural fertility and a low content of organic matter. Added fertilizers leach readily. Unless limed, Klej soils are extremely acid or very strongly acid throughout their profile. Permeability is rapid above the clayey substratum and slow within it. If drained the soils have a low available water capacity. The water table, however, provides additional water for plants early in the growing season.

Klej soils have a seasonal high water table at a depth of 1½ to 4 feet. During periods of normal rainfall the water table starts to rise about late in October, reaches its peak in January, starts to drop in April, and is generally at a depth of 5 feet or below by June.

These soils are subject to soil blowing in areas that are cleared and used for cultivated crops. They generally need drainage if they are used for high-value cultivated crops. Where the soils are drained, they warm early in spring and are easily worked.

Natural vegetation consists of black, scarlet, and white oak; blackgum; Virginia and pitch pine; and an understory of lowbush blueberry, sheep laurel, sassafras, gallberry, and holly. Some areas of Klej soil have been cleared so that fruit trees or vegetables can be grown, but most areas are still wooded. Drainage is generally necessary for most cultivated crops. During

periods of drought these soils need irrigation in areas used for high-value crops.

Representative profile of Klej loamy sand, 0 to 3 percent slopes, in a wooded area, 1,000 feet east of intersection of U.S. Highway 40 and County Road 552, 200 feet south of road in Hamilton Township:

A11—0 to 2 inches, dark grayish brown (10YR 4/2) loamy sand; very weak, granular structure; very friable; many roots; extremely acid; abrupt, smooth boundary.

A12—2 to 10 inches, pale brown (10YR 6/3) loamy sand; very weak, granular structure; very friable; many roots; extremely acid; abrupt, smooth boundary.

B21—10 to 24 inches, yellowish brown (10YR 5/6) loamy sand; single grained; loose; common roots; very strongly acid; clear, smooth boundary.

B22—24 to 36 inches, brownish yellow (10YR 6/6) loamy sand that has common, medium, distinct, light brownish gray (10YR 6/2) mottles; single grained; loose; very strongly acid; gradual, smooth boundary.

C1—36 to 52 inches, brownish yellow (10YR 6/6) sand that has common, medium, distinct, light gray (10YR 7/2) mottles; single grained; loose; very strongly acid.

C2g—52 to 60 inches, light gray (10YR 7/2) sand that has common, medium, distinct, pale brown (10YR 6/3) mottles; single grained; loose; very strongly acid.

Depth to low-chroma mottles ranges from 16 to 40 inches and averages about 25 inches.

The A11 horizon is dark grayish brown (10YR 4/2 or 2.5Y 4/2) or very dark grayish brown (10YR 3/2). Hue in the A12 horizon is 10YR, and value is 5 to 7. Where the soils are cultivated, the Ap horizon is dark grayish brown (10YR 4/2) or very dark grayish brown (10YR 3/2). The B horizon is yellowish brown (10YR 5/4) to olive yellow (2.5Y 6/6). In the C horizon matrix colors are brownish yellow (10YR 6/6) or yellowish brown (10YR 5/6) to light yellowish brown (2.5Y 6/4). Mottles of light brownish gray (10YR 6/2 or 2.5Y 6/2), light gray (10YR 7/2), pale brown (10YR 6/3), or grayish brown (10YR 5/2) are in this horizon. Matrix colors below a depth of 40 inches is light gray (10YR 7/2), grayish brown (10YR 5/2), or pale brown (10YR 6/3). In some profiles the matrix is yellowish brown (10YR 5/8) or brownish yellow (10YR 6/8), and mottles are grayish brown (10YR 5/2 or 2.5Y 5/2). The C horizon is loamy sand or sand. In places sandy loam or finer textured material is below a depth of 40 inches.

Klej soils are near Evesboro, Downer, Fort Mott, Lakehurst, Hammonton, Lakewood, and Atsion soils. Klej soils have low-chroma mottles, unlike Evesboro, Downer, and Fort Mott soils. They have neither the sandy loam B horizon typical of Hammonton soils nor the thick, bleached A2 horizon typical of Lakehurst, Lakewood, and Atsion soils.

KmA—Klej loamy sand, 0 to 3 percent slopes. This nearly level soil has the profile described as representative of the series. Included in mapping, however, are some areas of soils that have slopes of more than 3 percent. Also included are areas of Downer, Evesboro, Hammonton, Lakehurst, and Atsion soils.

This soil is rapidly permeable throughout its profile. Low fertility, the hazard of soil blowing, and wetness are the main limitations to the use of this soil for growing crops. If this soil is drained, the low available water capacity is likely to limit crop growth. If high-value crops are grown, this soil needs drainage by subsurface drains or open ditches. It has a slight hazard of water erosion and a moderate hazard of soil blowing where large areas are used for growing crops. Winter cover crops and windbreak hedges are generally used to control soil blowing. If this soil is to be used for septic filter fields or as a site for a house that has a basement, deep drainage is necessary. This soil has a hazard of ground-water pollution. Capability unit IIIw–16; woodland suitability group 3s1.

KnA—Klej loamy sand, clayey substratum, 0 to 3 percent slopes. This soil has a profile similar to the one described as representative of the series, but it has a substratum of clay or sandy clay at a depth of 40 to 60 inches. The clayey horizon is slowly permeable. In places in areas of more sloping soil, water moves laterally over the clayey substratum. The water table is perched over the clay, and the water level rises readily during periods of abnormally heavy rainfall.

Where large areas are cleared and used for growing crops, this soil has a slight hazard of water erosion and a moderate hazard of soil blowing. Windbreak hedges and winter cover crops are generally used to control erosion. If this soil is farmed, drainage improvement is necessary, either by subsurface drains or open ditches. This soil has a severe limitation to use for septic filter fields because of the slowly permeable substratum. If used as a site for a ground-water pond, the rate of recharge is slow if the clayey substratum is thick. Capability unit IIIw–16; woodland suitability group 3s1.

Lakehurst Series

The Lakehurst series consists of nearly level, moderately well drained and somewhat poorly drained, sandy soils that have a bleached subsurface layer. Most of these soils are moderately well drained. The Lakehurst soils occupy intermediate positions and depressional areas on the landscape.

In a representative profile in a wooded area the surface layer is black sand 2 inches thick. The subsurface layer is light-gray sand 9 inches thick. The subsoil is 21 inches thick. The upper 3 inches is organically stained, dark reddish-brown loamy sand. The lower 18 inches is mottled, yellowish-brown sand. The substratum, between depths of 32 and 60 inches, is light brownish-gray sand that has yellowish-brown and pale-brown mottles.

These soils have very low natural fertility and a low content of organic matter. Added fertilizers leach readily. Unless limed, Lakehurst soils are extremely acid in the surface layer and very strongly acid in the subsoil and substratum. Permeability is rapid. The soils have a low available water capacity. The high water table, however, provides additional water for plants.

The soils have a seasonal high water table at a depth of 1½ to 4 feet. During periods of normal rainfall the water table starts to rise in late October, reaches its peak early in January, starts to drop early in April, and drops to a depth of 6 feet or below in July or August.

These soils are subject to soil blowing in cleared areas. Where the soils are cleared and drained they warm early in spring and are easily worked.

Most areas of these soils are wooded. Trees that grow naturally are mostly pitch pine, white and black oak, blackgum, and hickory. The understory is lowbush blueberry, sheep laurel, and scattered gallberry. Because of the very low fertility, low available water

capacity, and rapid permeability, these soils are poorly suited to cultivated crops. Where large areas of Atsion soils are cleared for blueberry planting, adjacent small areas of Lakehurst soils are also cleared and planted. These soils are poorly suited to blueberry production because of the low water table in summer. Land-smoothing and the addition of organic material before planting are common where blueberries are to be grown. Irrigation is necessary where these soils are used for blueberry production. In places areas of these soils are used for growing grapes. The fluctuating water table is a concern if the soils are used for septic fields or for building sites for houses that have basements. Deep drainage is effective in lowering the water table, because the soil material is coarse and permeability is rapid.

Representative profile of Lakehurst sand, 0 to 3 percent slopes, in a wooded area in Mullica Township, 3 miles south of Pleasant Mills on County Road 23, 200 feet east of road:

A1—0 to 2 inches, black (10YR 2/1) sand; weak, medium, granular structure; very friable; many roots; extremely acid; abrupt, smooth boundary.

A2—2 to 11 inches, light gray (10YR 6/1) sand; single grained; loose; common roots; extremely acid; abrupt, wavy boundary.

B2h—11 to 14 inches, dark reddish brown (5YR 3/2) loamy sand; loose; single grained; few firm nodules; few roots; very strongly acid; clear, wavy boundary.

B3—14 to 32 inches, yellowish brown (10YR 5/6) sand; many, coarse, distinct, light gray (10YR 7/2) mottles; single grained; loose; very strongly acid; abrupt, smooth boundary.

C1g—32 to 39 inches, light brownish gray (10YR 6/2) sand; common, coarse, distinct, yellowish brown (10YR 5/4) mottles; single grained; loose; very strongly acid; abrupt, smooth boundary.

C2g—39 to 60 inches, light brownish gray (10YR 6/2) sand; common, medium, faint, pale brown (10YR 6/3) mottles; single grained; loose; 10 percent rounded quartzose pebbles; very strongly acid.

Thickness of the solum ranges from 20 to 40 inches, but the average thickness is about 26 inches. The solum is dominantly sand, but in places it is loamy sand. The soil material is less than 10 percent gravel in most areas, but in places parts of the C horizon are as much as 30 percent gravel. Mottling is faint or absent in many profiles.

The A1 horizon is black (10YR 2/1), very dark grayish brown (10YR 3/2), or dark gray (10YR 4/1). In the A2 horizon value is 5 or 6, and chroma is 1 or 2. The B horizon ranges from dark reddish brown (5YR 3/2) to yellowish brown (10YR 5/6). In general, thickness of the Bh horizon ranges from 0 to 6 inches. The average thickness is about 1 inch. Boundaries of the Bh horizon range from wavy to broken. Mottling is apparent in less than half of the B3 horizon. Higher chroma mottling is present in the B3 horizon of some profiles. The C horizon is sand, gravelly sand, and sandy loam. Hue is 10YR, value is 5 or 6, and chroma is 2 to 6. Mottles that have chroma of 2 to 6 are generally in the lower parts of the C horizon.

Lakehurst soils are near areas of Lakewood, Atsion, Evesboro, Klej, and Berryland soils. Unlike Atsion and Berryland soils, Lakehurst soils have yellowish-brown hues in the lower part of the B horizon; unlike Lakewood soils, they have low-chroma colors in the C horizon. Lakehurst, unlike Klej and Evesboro soils, have a bleached A2 horizon more than 7 inches thick.

LaA—Lakehurst sand, 0 to 3 percent slopes. This soil has the profile described as representative of the series. Included in mapping are areas where the soil has slopes of slightly more than 3 percent. Also included are areas of Klej, Downer, Evesboro, Atsion, and Lakewood soils.

This soil is subject to soil blowing in cleared areas. Windbreak hedges and cover crops can be used to control soil blowing and maintain the content of organic matter. This soil is poorly suited to crop production because of the very low fertility, low available water capacity, hazard of soil blowing, and wetness. The loose sand limits the use of this soil for campsites (fig. 11). Capability unit IVw–17; woodland suitability group 4s1.

Lakewood Series

The Lakewood series consists of nearly level to sloping, excessively drained, sandy soils that have a bleached subsurface layer. They formed in highly quartzose sandy sediment and occupy high positions of the landscape.

In a representative profile in a wooded area the surface layer is very dark grayish-brown sand 2 inches thick. The bleached subsurface layer is light brownish-gray sand 10 inches thick. The subsoil is sand 28 inches thick. The upper 4 inches is brown, and the lower 24 inches is yellowish brown. The substratum, between depths of 40 and 60 inches, is brownish-yellow sand that is faintly stratified with discontinuous layers of dark-brown sandy loam.

These soils have very low natural fertility and low content of organic matter. Unless frequently limed, they are extremely acid or very strongly acid throughout their profile. Permeability is rapid, and available water capacity is low. Lakewood soils have a seasonal high water table below a depth of 5 feet.

Lakewood soils are easily worked. Large cleared areas of these soils are subject to soil blowing. Soil temperatures are high in summer, and at times tomatoes and peppers become scorched. Added fertilizers leach readily, and it is very difficult to improve the fertility of these soils. The soils have slight limitations for septic filter fields, and their rapid permeability creates a hazard of ground-water pollution. In areas of more sloping soils, special design of the septic filter field may be necessary. The soils have severe limitations for recreational uses because of poor trafficability and the hazard of dust.

Natural vegetation consists mainly of pitch pine but also includes chestnut oak, black oak, and white oak. Where wildfires have been severe, the dominant vegetation is pitch pine, scrub oak, and blackjack oak. Lakewood soils are not generally used for crops. Some areas were once cleared for farming, but most of these have been abandoned. The only remaining large cultivated areas are used for growing grapes. Most areas are wooded and are used for pulpwood production.

Representative profile of Lakewood sand, 0 to 5 percent slopes, in a wooded area in the northern part of Mullica Township, ½ mile east of Columbia Road on Sailor Boy Road:

A1—0 to 2 inches, very dark grayish brown (10YR 3/2) sand; single grained; loose; many roots; extremely acid: clear, smooth boundary.

A2—2 to 12 inches, light brownish gray (10YR 6/2) sand; single grained; loose; many roots; extremely acid; clear, smooth boundary.

Figure 11.—**Campers on Lakehurst sand, 0 to 3 percent slopes.**

B21h—12 to 16 inches, brown (10YR 5/3) sand, light brownish gray (10YR 6/2) tongues; single grained; loose; common roots; extremely acid; clear, smooth boundary.

B22—16 to 31 inches, yellowish brown (10YR 5/6) sand; single grained; loose; few roots; extremely acid; gradual, smooth boundary.

B3—31 to 40 inches, yellowish brown (10YR 5/8) sand; single grained; loose; few roots; very strongly acid; gradual, smooth boundary.

C—40 to 60 inches, brownish yellow (10YR 6/6) sand; single grained; loose; stratified layers of dark brown (10YR 3/3) sandy loam, ¼ inch thick; very strongly acid.

The solum ranges from 24 to 40 inches in thickness. Depth to the Bh horizon ranges from 8 to 24 inches. Gravel is generally absent, but it makes up as much as 15 percent of some thin layers. The profile is generally sand throughout.

In the A1 horizon, hue is 10YR, value is 3 to 7, and chroma is 1 or 2. The A2 horizon ranges from grayish brown (2.5Y 5/2) to light gray (10YR 7/1). The B horizon is dominantly sand but in places is loamy sand. It ranges from brown (10YR 5/3) to brownish yellow (10YR 6/8). Hue is 10YR, 7.5YR, or 5YR in the Bh horizon (where present), value is 4 to 6, and chroma is 3 or 4. The C horizon is dominantly sand but in places is loamy sand. It is yellow (2.5Y 7/6) to light yellowish brown (10YR 6/4).

Lakewood soils are near areas of Evesboro, Lakehurst, Klej, and Atsion soils. They have a thicker bleached A2 horizon than the one in Evesboro soils. Lakewood soils have neither the low-chroma mottles in the B horizon nor the low matrix colors in the C horizon that are typical of Lakehurst and Klej soils nor the dark-colored A horizon and low-chroma matrix that are typical of Atsion soils.

LeB—Lakewood sand, 0 to 5 percent slopes. This nearly level or gently sloping soil has the profile described as representative of the series. Most areas are on broad uplands near large streams.

Included with this soil in mapping are areas of Evesboro, Lakehurst, and Klej soils. The Klej soils are in depressions. Some areas of more sloping Lakewood and Evesboro soils are also included. They are indicated on the map by escarpment symbols. Small depressional areas of poorly drained soils are indicated on the map by wet spot symbols.

Areas of this soil that are cleared and used for farming are subject to soil blowing. Windbreak hedges or cover crops can be used to control soil blowing. Very low fertility, low available water capacity, and the hazard of soil blowing are the main limitations to crop production. Capability unit VIIs-8; woodland suitability group 5s1.

LeC—Lakewood sand, 5 to 10 percent slopes. This soil is along streams and narrow drainageways. It has

short, convex slopes. This soil is similar to the one described as representative of the series, but it has steeper slopes. Most areas are long and narrow. Included in mapping are areas of steeper Evesboro soils.

This soil has a moderate hazard of erosion in cleared areas. The very low fertility and low available water capacity are the main limitations to the use of this soil for crops. Capability unit VIIs–8; woodland suitability group 5s1.

Matawan Series

The Matawan series consists of moderately well drained, loamy soils. They generally occupy intermediate positions on the landscape. Some areas are slightly depressional.

In a representative profile in a wooded area the surface layer is dark grayish-brown sandy loam 7 inches thick. The subsurface layer is light yellowish-brown sandy loam 9 inches thick. The subsoil is light yellowish-brown or olive-yellow sandy loam and clay loam 26 inches thick. It has yellowish-brown and grayish-brown mottles in the lower part. The substratum, between depths of 42 and 60 inches, is pale-olive, stratified clay loam, sandy clay, and sandy clay loam. It has light-gray mottles.

These soils have medium natural fertility and moderate content of organic matter. Unless limed, Matawan soils are extremely acid or very strongly acid. Permeability is moderately slow. These soils have a moderate available water capacity. The water table, however, provides additional water for plants in spring.

Matawan soils have a seasonal high water table perched at a depth of 1½ to 3 feet. During periods of normal rainfall, the water table starts to rise about the middle of October, reaches its peak about January, and starts to drop about April. In some areas these soils are ponded for short periods during winter and spring. The soils have a slight to moderate hazard of water erosion in cleared and cultivated areas. Because of the moderately high water table and moderately slow permeability of the subsoil, these soils generally warm later in the spring than most other sandy loams in the county.

Natural vegetation consists dominantly of scarlet, white, and black oak; scattered pitch pine; and an understory of sassafras, holly, mountain laurel, and sheep laurel. Some areas have been cleared so that fruits and vegetables can be grown, but most areas are wooded. These soils have severe limitations for septic filter fields because of moderately slow permeability and the perched seasonal high water table.

Representative profile of Matawan sandy loam, 0 to 5 percent slopes, in a wooded area in Hamilton Township, ¼ mile east of South River on Bears Head Road, 1 mile north on a road in the woods:

A1—0 to 7 inches, dark grayish brown (10YR 4/2) sandy loam; weak, medium, granular structure; very friable; many roots; extremely acid; abrupt, smooth boundary.

A2—7 to 16 inches, light yellowish brown (2.5Y 6/4) sandy loam; weak, medium, granular structure; very friable; many roots; extremely acid; abrupt, smooth boundary.

B21t—16 to 24 inches, light yellowish brown (10YR 6/4) sandy loam; moderate, fine and medium, subangular blocky structure; friable; common roots; thin, patchy clay films on faces of peds; very strongly acid; clear, smooth boundary.

IIB22t—24 to 31 inches, olive yellow (5Y 6/6) clay loam; fine, medium, distinct, light brownish gray (2.5Y 6/2) and brownish yellow (10YR 6/6) mottles; moderate, medium, angular blocky structure; firm; few roots; thin, continuous clay films on faces of peds; very strongly acid; clear, smooth boundary.

IIB23t—31 to 42 inches, light yellowish brown (2.5Y 6/4) clay loam; common, medium, distinct, yellowish brown (10YR 5/8) and common, faint, grayish brown (10YR 5/2) mottles; moderate, medium, angular blocky structure; firm; few roots; thin, continuous clay films on faces of peds; very strongly acid; clear, smooth boundary.

IIIC—42 to 60 inches, pale olive (5Y 6/3) stratified clay loam, sandy loam, and sandy clay loam; common, medium, distinct, light gray (10YR 7/2) mottles; massive; very strongly acid.

The solum ranges from 30 to 50 inches in thickness. The soil material is generally less than 5 percent gravel throughout the profile.

The A horizon is sandy loam. In the A1 horizon hue is 10YR or 2.5Y, value is 4 to 6, and chroma is 2 to 4. In the A2 horizon hue is 2.5Y or 10YR, value is 5 or 6, and chroma is 3 or 4. In the upper part of the Bt horizon, hue is 10YR or 2.5Y, value is 5 or 6, and chroma is 4 to 6. This layer is dominantly sandy loam but ranges to sandy clay loam. In the lower part of the Bt horizon, hue is 5Y or 2.5Y, value is 5 or 6, and chroma is 4 to 6. Low-chroma mottles are generally present in the B22t horizon. This horizon is dominantly clay loam but ranges to sandy clay loam and sandy clay. In the C horizon hue is 2.5Y or 5Y, value is 6 or 7, and chroma is 1 to 3.

Matawan soils are near areas of Aura, Sassafras, Woodstown, and Hammonton soils. Unlike Aura and Sassafras soils, Matawan soils have a B horizon that has gray mottles. Matawan soils have a finer textured B horizon than Hammonton and Woodstown soils.

MtA—Matawan sandy loam, 0 to 5 percent slopes. This soil is nearly level or gently sloping. Some areas of it are in depressions.

Included with this soil in mapping are areas of soils that have a surface layer of loamy sand. Also included are areas of Sassafras and Aura soils in slightly higher positions than those of this soil and areas of very poorly drained Pocomoke soils in narrow drainageways.

Wetness is the main limitation to the use of this soil. Areas that are cleared and used for crops generally need open-ditch drainage. Land grading, diversions, open ditches, and random tile systems are used to reduce wetness and drain depressions. Capability unit IIe–2; woodland suitability group 2o1.

Muck

MU—Muck. This nearly level, very poorly drained soil consists of finely decomposed organic matter ranging in thickness from 16 inches to 4 feet or more. The underlying material in most places is sand or gravelly sand, but in some places this material is finer textured. Muck occupies areas adjacent to streams. It is generally on broad flats under a dense forest of Atlantic white cedar.

Muck has medium natural fertility and a high content of organic matter. It is extremely acid throughout the profile. Permeability is rapid, and available water capacity is high.

The high water table is at the surface, and Muck is saturated 10 to 12 months of the year. The table drops only 1 or 2 feet, and then only during extremely droughty summers.

Muck is poorly suited to farming. The soil is generally shallow, and it is extremely acid. Muck subsides severely upon drying, and it is subject to frequent flooding. Also, it is difficult to drain.

Natural vegetation consists mostly of Atlantic white cedars that have root systems extending into almost liquid muck. The cedars, therefore, are subject to windthrow, and the hazard of this is severe. In many areas where the cedars have been cut, red maple has replaced them. These areas have a dense understory of highbush blueberry, sweet pepperbush, and greenbrier. Some areas of Muck have been cleared and are used to grow cranberries, but most areas are wooded. Damage to vegetation by fire is a hazard during extremely dry periods. Capability unit VIIw-30; woodland suitability group 3w2.

Pocomoke Series

The Pocomoke series consists of nearly level, very poorly drained, loamy soils in broad, swampy depressions and narrow drainageways. They occupy very low positions on the landscape. Some narrow areas are adjacent to small streams.

In a representative profile in a wooded area the surface layer is black sandy loam 10 inches thick. The subsurface layer is gray sandy loam 8 inches thick. The subsoil is gray sandy loam 10 inches thick. The substratum, to a depth of 60 inches, is gray gravelly sand in the upper 12 inches and grayish-brown sand in the lower 20 inches.

These soils have medium natural fertility and high content of organic matter. Unless limed, Pocomoke soils are extremely acid in the surface layer and extremely acid or very strongly acid in the subsoil. Permeability is moderate if the soils are drained. These soils have moderate available water capacity. The water table, however, provides additional water for plants.

The soils have a seasonal high water table at the surface. During periods of normal rainfall the water table starts to rise in September, reaches its peak early in December, remains at or near the surface until May, and drops to a depth of about 2 feet in summer. Where these soils are adjacent to small streams, they are subject to occasional flooding by stream overflow. Surface ponding occurs in the small depressions. Because of their low positions on the landscape, the soils receive runoff from higher slopes.

Because of the high water table, these soils warm late in spring and become wet early in fall. Since they remain wet until late spring, they are not easily worked.

Natural vegetation consists mostly of blackgum, sweetgum, red maple, bay magnolia, white oak, pin oak, willow oak, and holly. The dense understory consists mostly of highbush blueberry, sweet pepperbush, gallberry, and greenbrier. Some areas of Pocomoke soils have been cleared so that blueberries or vegetables can be grown, but most areas are wooded. Areas cleared for blueberry production need smoothing to prevent ponding and to prepare the land for tillage equipment and harvesters. The water table is generally lowered by ditch drainage and controlled by structures in the ditches or by various types of irrigation systems. The water level is maintained at a depth of about 2 feet below the surface during the growing season.

These soils have severe limitations for community development, and septic systems generally fail seasonally (fig. 12).

Representative profile of Pocomoke sandy loam in a wooded area, 1 mile west of Atlantic Shores Council Girl Scout Camp in Hamilton Township:

O1—3 to 0 inches, leaf mull and root material.

A1—0 to 10 inches, black (10YR 2/1) sandy loam; weak, medium, granular structure; very friable; many roots; extremely acid; abrupt, smooth boundary.

A2g—10 to 18 inches, gray (10YR 5/1) sandy loam; weak, medium, subangular blocky structure; friable; common roots; common medium pores; extremely acid; clear, smooth boundary.

B2tg—18 to 28 inches, gray (5Y 6/1) sandy loam; common, medium, faint, pale olive (5Y 6/3) mottles; weak, medium, subangular blocky structure; friable; few roots; common medium pores; clay bridges between sand grains; very strongly acid; clear, smooth boundary.

C1g—28 to 40 inches, gray (10YR 6/1) gravelly sand; single grained; loose; 20 percent rounded quartzose pebbles; very strongly acid; clear, smooth boundary.

C2g—40 to 60 inches, grayish brown (10YR 5/2) sand; single grained; very strongly acid.

The solum ranges from 22 to 40 inches in thickness and averages about 32 inches. Rounded quartzose pebbles are generally most abundant in the C horizon, but in some profiles they are in the A and B horizons.

In the A1 horizon hue is 10YR, 2.5Y, or 5Y; value is 2 or 3; and chroma is 1 or 2. In the Btg horizon hue is 10YR, 2.5Y, or 5Y; value is 3 to 6; and chroma is 0 to 2. Mottles in this horizon range from faint to prominent and from few to many. In the C horizon, hue is 10YR to 5Y, value is 3 to 6, and chroma is 0 to 2. The C horizon generally has stratified layers of sand and loamy sand. Texture ranges to sandy loam or sandy clay loam in this horizon below a depth of 40 inches.

Pocomoke soils are near areas of Atsion, Berryland, Hammonton, and Woodstown soils. They do not have the dark-colored Bh horizon typical of Atsion and Berryland soils. Unlike Hammonton and Woodstown soils, Pocomoke soils have a gray B horizon.

Po—Pocomoke sandy loam. This soil is in broad, nearly level or depressional areas and in narrow drainageways. Some narrow areas of this soil that are adjacent to small streams are subject to flooding.

Included with this soil in mapping are areas of Berryland soils, Muck, and Atsion soils. Also included are large areas of soils that do not have a thick, dark surface layer and whose subsoil is not as gray. In most places the soils in these areas have mottles that range from few to many and from faint to prominent. In places the substratum is sandy clay or clay that is generally below a depth of 40 inches and ranges considerably in thickness. These areas are not continuous enough to be mapped separately.

Drainage is necessary if this soil is used for crops. If the soil is adequately drained, late vegetables can be grown. It is not suited to such perennial plants as peaches, apples, and grapes. If outlets are available,

Figure 12.—**Excavations in Pocomoke soils reveal the high water table.**

open ditches or subsurface drains can be used to lower the water table. This soil is well suited to blueberries if the water table is controlled. It is generally a good site for ground-water ponds. In places where the soil has a thick, clayey substratum, the rate of recharge may be slow. Capability unit IIIw–25; woodland suitability group 2w1.

Sassafras Series

The Sassafras series consists of nearly level and gently sloping, well-drained, loamy soils. They occupy high positions on the landscape.

In a representative profile in a cultivated area the plow layer is brown sandy loam 10 inches thick. The subsurface layer is yellowish-brown sandy loam 4 inches thick. The subsoil is 24 inches thick. The upper 4 inches is strong-brown, heavy sandy loam; the middle 12 inches is yellowish-brown sandy clay loam; and the lower 8 inches is brownish-yellow, heavy sandy loam. The substratum, between depths of 38 and 64 inches, is yellowish-brown loamy sand and strong-brown gravelly sand.

These soils have medium fertility and a moderate content of organic matter. Unless limed, Sassafras soils are extremely acid in the surface layer and very strongly acid below. They respond well to lime and fertilizer. Permeability is moderate. The soils have a high available water capacity. A seasonal high water table is at a depth of 5 feet or below.

Natural vegetation consists mostly of black, white, scarlet, and chestnut oak; pitch and shortleaf pine; hickory; and an understory mostly of laurel, sassafras, and lowbush blueberry. Sassafras soils are well suited to most crops commonly grown in the county. Most areas of Sassafras soils in the western part of the county are used for cultivated crops and fruit orchards. In other parts of the county, most areas are wooded. They have a severe limitation for sanitary landfill and slight limitations for most other community development uses.

Representative profile of Sassafras sandy loam, 0 to 2 percent slopes, in a cultivated area in Buena Vista Township; ½ mile northeast of intersection of Oak Road and Lincoln Avenue and 200 feet northwest of Lincoln Avenue:

Ap—0 to 10 inches, brown (10YR 5/3) sandy loam; weak, fine, granular structure; very friable; few roots; 5 percent quartzose gravel; medium acid; abrupt, smooth boundary.

A2—10 to 14 inches, yellowish brown (10YR 5/4) sandy loam; weak, fine, granular structure; very friable; few roots; less than 5 percent quartzose pebbles; medium acid; gradual, wavy boundary.

B1—14 to 18 inches, strong brown (7.5YR 5/6) heavy sandy loam; weak, medium, subangular blocky structure; friable; strongly acid; gradual, wavy boundary.

B2t—18 to 30 inches, yellowish brown (10YR 5/6) sandy clay loam; moderate, medium, subangular blocky structure; slightly firm; clay films in pebble niches; common clay bridges between sand grains; 10 percent quartzose pebbles; strongly acid; gradual, wavy boundary.

B3—30 to 38 inches, brownish yellow (10YR 6/8) heavy sandy loam; weak, medium, granular structure; friable; clay bridges between sand grains; clay

films in pebble niches; 10 percent quartzose pebbles; strongly acid; gradual, wavy boundary.

C1—38 to 50 inches, yellowish brown (10YR 5/8) loamy sand; weak, fine, granular structure; very friable; 10 percent quartzose pebbles; strongly acid; gradual, wavy boundary.

C2—50 to 64 inches, strong brown (7.5YR 5/8) gravelly sand; weak, fine, granular structure; very friable; 30 percent quartzose pebbles; strongly acid.

The solum ranges from 30 to 40 inches in thickness. Quartzose gravel makes up 5 to 20 percent of the material in most profiles, but in places as much as 30 percent of the substratum is quartzose gravel.

In the A horizon hue is 10YR or 7.5YR, value is 3 to 5, and chroma is 1 to 5. Low values and chroma are confined to the A1 horizon. In the B horizon hue ranges from 5YR to 10YR, value from 4 to 6, and chroma from 4 to 8. The Bt horizon is sandy clay loam or heavy sandy loam. Hue ranges from 10YR to 7.5YR, value is 5 or 6, and chroma is 4 to 8. The C horizon is stratified loamy sand, sand, or the gravelly analogs of these materials.

Sassafras soils are near areas of Downer, Aura, Fort Mott, Woodstown, and Hammonton soils. They have a finer textured Bt horizon than Downer soils. Sassafras soils have neither the very firm or hard, reddish lower part of the B horizon typical of Aura soils nor the grayish mottles typical of Woodstown and Hammonton soils. They do not have the thick, sandy A horizon typical of Fort Mott soils.

SaA—Sassafras sandy loam, 0 to 2 percent slopes. This soil has the profile described as representative of the series. Included in mapping are areas of Fort Mott, Downer, Aura, and Woodstown soils. The Woodstown soils are in depressions, and their drainage needs to be improved if high value crops are grown.

This soil is well suited to peaches, apples, grapes, potatoes, tomatoes, and many other vegetables. It has a slight hazard of water erosion. It is profitable to irrigate all high-value crops (fig. 13) grown in this soil. Capability unit I–5; woodland suitability group 3o1.

SaB—Sassafras sandy loam, 2 to 5 percent slopes. This soil is gently sloping, but it is otherwise similar to the one described as representative of the series. The average length of slopes is about 400 feet.

Included with this soil in mapping are areas of Downer, Fort Mott, and Aura soils. Also included are areas of Sassafras soils that have short slopes of more than 5 percent. Small areas of soils that have a gravelly surface layer are indicated on the map by gravel symbols.

This soil has a slight to moderate hazard of erosion. Cover crops generally are sufficient to maintain the content of organic matter and soil structure. Irrigation is profitable, and it improves most high-value crops. Capability unit IIe–5; woodland suitability group 3o1.

Tidal Marsh

In this county Tidal marsh generally has a mineral surface layer over highly organic material. Tidal marsh generally has complex sequences of mineral and muck strata underlain by sand.[2] The soil material is brownish. The sand generally is firm and compact and is at a depth of as much as 40 feet. It is possible that in places the underlying sand is thin over other organic deposits. These soils are almost continuously saturated, and bearing capacities are low.

Included with Tidal marsh in mapping, especially upstream along the Mullica River, are tidal areas encroaching Muck areas. These areas originally supported trees, but the trees were killed by the continuous flooding.

[2] By the use of a probe, the marshes were mapped according to depths to firmer material below. The depths selected were less than 3 feet, 3 to 8 feet, and more than 8 feet.

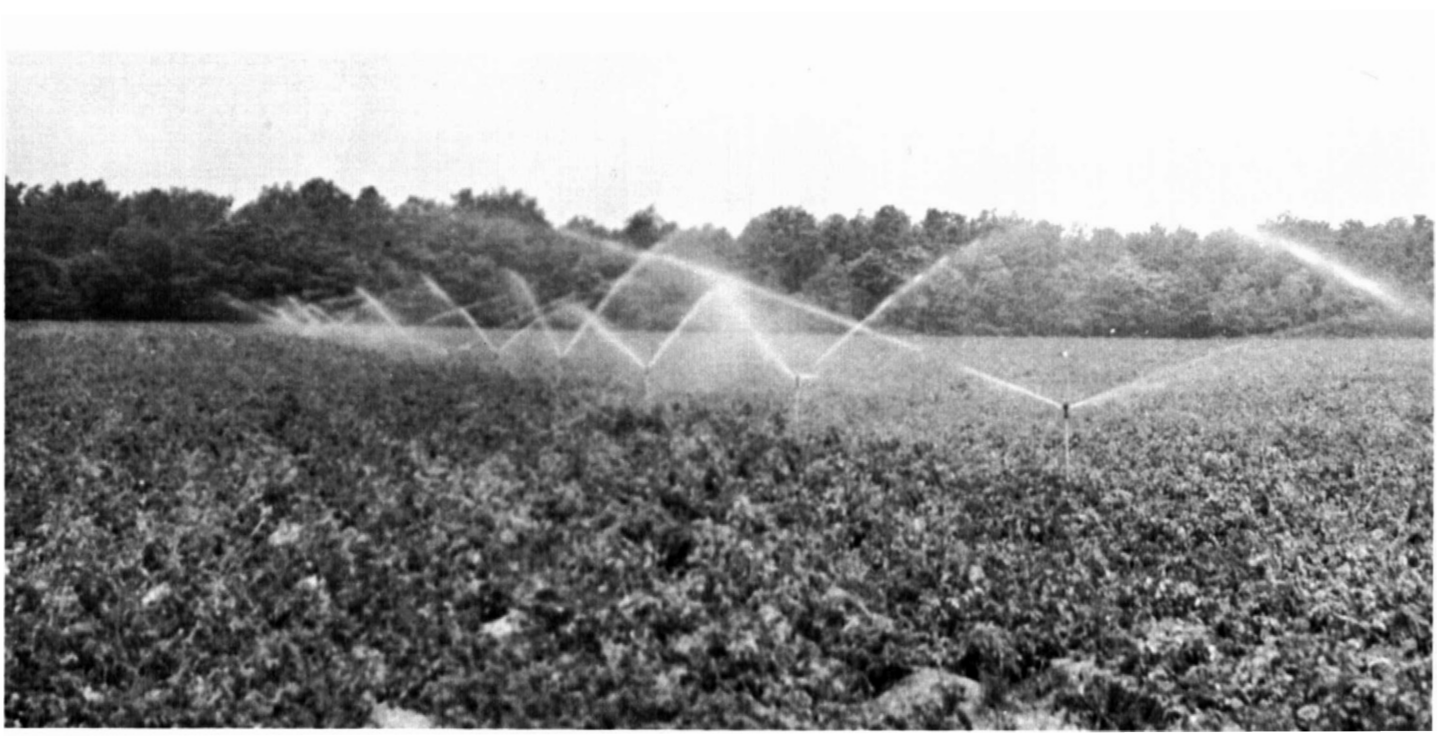

Figure 13.—**Irrigation system in a cropped area of Sassafras sandy loam, 0 to 2 percent slopes.**

The mineral material is slightly acid to alkaline, and the highly organic material is extremely acid to neutral. Upon drying and oxidizing, however, reaction changes to extremely acid, even to pH2 or less. Thus, the material is so strongly acid that no vegetation can grow in it. Content of organic matter and available water capacity are high in Tidal marsh. Tidal flooding occurs twice daily. Normal tides average 2 to 3 feet in height, but in coastal storms they are as high as 10 to 12 feet.

Natural vegetation consists of a variety of grasses that tolerate saltwater. Tidal marshes in this county were once mowed so that salt hay could be harvested. Salt hay was extensively used as mulch on new grass seedings and for such crops as strawberries. It was also used for curing cement used for concrete paving. Very little salt hay has been harvested in recent years.

During the past 50 years the mosquito commission has constructed many ditches to speed the drainage of flooded land and thus reduce the number of mosquito breeding pools. The soils are extremely valuable wildlife habitat for waterfowl, mammals, and crustaceans. In the Oceanville and Tuckahoe areas extensive areas of Tidal marsh have been diked to hold shallow depths of water seasonally for waterfowl management. A similar system can be used also for muskrat management. Iron and concrete in these soils are subject to severe corrosion.

TD—Tidal marsh, deep. This Tidal marsh has mineral and organic layers at a depth of more than 8 feet. Removal of organic deposits is extremely costly. Special foundation design is needed for all structures on this soil. Tidal marsh, deep, has a severe hazard of storm-tide flooding. It is not suited to trees. Capability unit VIIIw–29; not assigned to a woodland suitability group.

TM—Tidal marsh, moderately deep. This tidal marsh has a firm layer, generally sand, between depths of 3 and 8 feet. Special foundation design is needed for roads and buildings on this soil. Tidal marsh, moderately deep, has a severe hazard of storm-tide flooding. It is not suited to trees. Capability unit VIIIw–29; not assigned to a woodland suitability group.

TS—Tidal marsh, shallow. This Tidal marsh has a firm layer, generally sand, at a depth of 3 feet or less. Areas are small and are generally adjacent to uplands. Tidal marsh that is shallow to sand generally has the fewest limitations for foundation design. Special foundation design is necessary for buildings. Tidal marsh, shallow, has a severe hazard of storm-tide flooding. It is not suited to trees. Capability unit VIIIw–29; not assigned to a woodland suitability group.

Woodstown Series

The Woodstown series consists of nearly level, moderately well drained, loamy soils. They occupy intermediate positions on the landscape. The vegetative cover is dominantly hardwood forest.

In a representative profile in a cultivated area, the plow layer is dark grayish-brown sandy loam 10 inches thick. The subsoil is 22 inches thick. The upper 14 inches is light olive-brown light sandy clay loam. The lower 8 inches is olive-yellow sandy clay loam that contains grayish-brown mottles. The substratum, between depths of 32 and 42 inches, is pale-olive loamy sand. Between depths of 42 and 60 inches it is light brownish-gray sand.

These soils have medium natural fertility and moderate content of organic matter. Unless limed, Woodstown soils are extremely acid in the A1 horizon and very strongly acid below. Permeability is moderate in these soils.

The soils have a seasonal high water table at a depth of 1½ to 4 feet. During periods of normal rainfall the table starts to rise about the middle of October, reaches its peak early in January, starts to drop about early in April, and drops to a depth of 5 feet or below by summer.

These soils generally receive runoff from higher slopes. Surface ponding occurs in some areas. Because of the seasonal high water table, these soils warm slowly in spring.

Natural vegetation consists mostly of white, red, and black oak; pitch pine; and an understory of holly, mountain laurel, sheep laurel, lowbush blueberry, and greenbrier. About half the areas of Woodstown soils are wooded. Areas that have been cleared are used for growing fruits and vegetables. These areas need drainage improvement; either open ditches or underdrains can be used. High-value crops are generally irrigated. If Woodstown soils are to be used for septic filter fields or as sites for homes that have a basement, they need to be deeply drained.

Representative profile of Woodstown sandy loam in a cultivated area in the Borough of Buena, ¼ mile north of U.S. Highway 40 on Cedar Lake Road, 200 feet east of road:

Ap—0 to 10 inches, dark grayish brown (10YR 4/2) sandy loam; moderate, medium, granular structure; very friable; many fine roots; slightly acid; abrupt, smooth boundary.

B21t—10 to 24 inches, light olive brown (2.5Y 5/6) light sandy clay loam; weak, medium, subangular blocky structure; friable when moist; slightly plastic when wet; many fine roots; thin, patchy clay films on faces of peds; some clay bridges; strongly acid; clear, smooth boundary.

B22t—24 to 32 inches, olive yellow (2.5Y 6/6) sandy clay loam; common, medium, distinct, grayish brown (2.5Y 5/2) mottles; moderate, medium, subangular blocky structure; plastic when wet; few medium roots; thin, continuous clay films on faces of peds; very strongly acid; clear, smooth boundary.

IIC1—32 to 42 inches, pale olive (5Y 6/3) loamy sand; common, medium, faint grayish brown (2.5Y 5/2) mottles; single grained; loose; very strongly acid; gradual, smooth boundary.

IIC2g—42 to 60 inches, light brownish gray (2.5Y 6/2) sand; many, medium, faint, light olive gray (5Y 6/2) mottles; single grained; loose; very strongly acid.

The solum ranges from 24 to 40 inches in thickness and averages about 35 inches. Gravel rarely makes up more than 5 percent of the solum and 10 percent of the C horizon.

In the A horizon hue is 2.5Y or 10YR, value is 4 to 6, and chroma is 1 to 4. The low value and chroma are confined to the A1 horizon. The Ap horizon is slightly browner in cultivated areas than it is in uncultivated areas. In the B2 horizon hue is 2.5Y or 10YR, value is 5 or 6, and chroma is 4 to 8. The B21t horizon is heavy sandy loam or sandy clay loam. It has high-chroma mottles in places. In the C horizon hue is 2.5Y or 5Y, value is 6 or 7, and chroma is 2,

3, or 4. The stratified C horizon is dominantly loamy sand, but it includes sand and sandy loam. In places texture is as fine as clay loam or sandy clay below a depth of 40 inches.

Woodstown soils are near areas of Sassafras, Aura, Downer, Hammonton, and Matawan soils. They have a B horizon that has low-chroma mottles, unlike Sassafras, Aura, and Downer soils. They have a finer textured B horizon than Hammonton soils and a coarser textured B horizon than Matawan soils.

WcA—Woodstown sandy loam, 0 to 2 percent slopes. This soil is nearly level to depressional. Some areas are in narrow drainageways. In some areas this soil is underlain, below a depth of 40 inches, by material that is as fine textured as clay loam or sandy clay.

Included with this soil in mapping are area of Sassafras, Aura, and Downer soils in slightly higher positions and areas of Hammonton soils in similar positions. Areas of Pocomoke soils are included in lower positions and in narrow drainageways. Also included are areas of soils that have low-chroma mottles nearer the surface than those in the representative profile.

If this soil is adequately drained, it is suited to growing fruits and vegetables. Cover crops are generally sufficient to maintain the content of organic matter. Capability unit IIw–14; woodland suitability group 2o1.

Use and Management of the Soils

The soils of Atlantic County are used mainly for woodland and crops. In this section management of the soils for those uses is explained, and the soils are rated according to their productivity for the principal crops. The section also contains information about management of the soils for wildlife habitat, use of the soils for engineering purposes, and town and country planning.

The information in this section is to be used as a general guide for managing the soils and not as specific management procedure for individual soils. Detailed information about managing the soils can be obtained from the local staff of the Soil Conservation Service, from the Agricultural Extension Service, or from the Agricultural Experiment Station, Cook College, Rutgers, the State University.

General Use and Management for Crops

In 1969, 31,478 acres in Atlantic County were farmland. Of this, 18,608 acres were in crops. The most extensively grown crop is peaches. Other important crops are sweet corn, peppers, sweet potatoes, tomatoes, apples, and blueberries. About 8,000 acres are irrigated each year.

The principal concerns in managing the soils for the production of crops are maintaining fertility, providing drainage, and controlling erosion. Management practices suitable for crops are discussed in the mapping unit descriptions.

Additions of lime and fertilizer are needed on all soils in the county that are farmed. The amounts depend on the natural content of lime and plant nutrients, on past cropping and level of management, on the need of the crop, and on the level of yield desired. Suggestions for additions of lime and fertilizer are only general in this survey. Fields should be limed and fertilized according to the results of soil tests and in accordance with current recommendations of the Agricultural Extension Service and Cook College, Rutgers, the State University.

The soils of Atlantic County have a low to high content of organic matter. This can be maintained or increased through proper management of residue. Such good management practices include plowing in cover crops, growing a sod crop in the cropping sequence, and returning crop residue to the soil. Commercial fertilizer is beneficial to all crops. It is better to add fertilizer in more than one application during the growing season on soils such as Evesboro and Klej soils that are subject to rapid leaching.

Tillage is needed to prepare a seedbed and to control weeds. It should be kept to a minimum, however, because excessive tillage generally tends to break down the structure of the soil. Adding organic matter and growing sod crops, cover crops, and green manure crops help prevent a breakdown of structure.

When they are farmed, all of the sloping soils in the county are subject to erosion and to loss of organic matter and plant nutrients from the surface layer. Because most erosion occurs while the cultivated crop is growing or soon after the crop has been harvested, a cropping sequence and practices that keep the loss of soil and water to a minimum should be selected. These practices are contour planting, using minimum tillage, properly using crop residue, planting cover crops, and applying fertilizer and lime when needed.

In Atlantic County many of the soils are wet because of a fluctuating water table. Examples of wet soils are Berryland, Atsion, and Pocomoke soils and Muck. The water table can be lowered by open ditches or subsurface drains. Where tile drainage is practical, it generally provides better drainage than open ditches. Suitable outlets are required for drainage by either system.

Capability grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are so used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to blueberries, cranberries, horticultural crops, or other crops that require special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for forest trees, or for engineering.

In the capability system, the kinds of soils are grouped at three levels; the capability class, subclass, and unit. These are discussed in the following paragraphs.

CAPABILITY CLASSES, the broadest groups, are designated by Roman numerals I through VIII. The numerals indicate progressively greater limitations and narrower choices for practical use, defined as follows:

- Class I soils have few limitations that restrict their use.
- Class II soils have moderate limitations that reduce the choice of plants or that require moderate conservation practices.
- Class III soils have severe limitations that reduce the choice of plants, require special conservation practices, or both.
- Class IV soils have very severe limitations that reduce the choice of plants, require very careful management, or both.
- Class V soils are not likely to erode but have other limitations, impractical to remove, that limit their use largely to pasture, woodland, or wildlife habitat.
- Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture, woodland, or wildlife habitat.
- Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture, woodland, or wildlife habitat.
- Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife habitat, water supply, or esthetic purposes.

CAPABILITY SUBCLASSES are soil groups within classes; they are designated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the United States and not in Atlantic County, shows that the main limitation is a climate that is too cold or too dry.

Class I has no subclasses because the soils have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, woodland, wildlife habitat, or recreation.

CAPABILITY UNITS are soil groups within subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-5 or IIIs-10. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass. Suggestions for the use and management of the soils are given in the mapping unit description. Since capability units in New Jersey are assigned for all of the soils in the Coastal Plain geologic province, the unit numbers in Atlantic County are not consecutive. Additional information on the system of capability grouping is given in the Land Capability Classification Agriculture Handbook No. 210 (*15*).

Estimated yields

Estimated indexes, or ratings, of yields of the principal crops on each soil are given in table 2. Ratings of 1 to 10 are given for yields expected at two levels of management. The lowest rating is 1, and the highest is 10. Table 3 shows how each rating is converted to yield.

Ratings in columns A are based on yields expected under the management used by most farmers in the county. Ratings in columns B are based on yields expected under the best current management for the crop on that soil. The ratings in columns B do not represent maximum yields obtained under ideal conditions. They are based on averages of yields obtained over a period of at least 4 years after allowing for exceptional weather and for pests and diseases. The differences between column A and column B for any crop may be the result of a single factor or a combination of factors. In general, all factors must be favorable to obtain yields represented by the ratings in columns B.

Details of the practices that are recommended to obtain high yields change somewhat from year to year. Current detailed recommendations are published each year in bulletins of the Agricultural Extension Service. In general, the recommended practices include the following: choosing varieties of crops that are suited to the soil and climate and are resistant to the common pests and diseases; treating seed by sterilizing or inoculating when appropriate; planting seed at the proper rate; and maintaining the proper number of plants per acre. Other good management practices include applying fertilizer after choosing the formula, amount per acre, and time of application in relation to the soil, crop, plant population, and amount of available water in the soil; applying lime according to soil tests and needs of the crop; taking measures to control pests, diseases, and weeds; installing drainage if the water table interferes with growth of crops; irrigating tomatoes, sweet corn, and other high-value crops; applying practices to control runoff, water erosion, and soil blowing; planting crops in an appropriate sequence; growing cover crops; using minimum tillage where applicable; and keeping the soil in good tilth.

Estimated yields on soils for which records are not available are based on yields from similar soils. The county agricultural agent and other agricultural leaders helped in making all of the estimates.

Woodland

The soils of Atlantic County have been placed in woodland suitability groups to assist owners in planning the use of their soils for wood crops. Each group

TABLE 2.—*Estimated average yield ratings of principal crops under two levels of management*

[Ratings are from 1, the lowest, to 10, the highest. Yield equivalents for ratings are listed in table 3. Ratings in columns A are for common management; those in columns B are the best current management. Absence of a rating indicates crop generally is not grown on this soil]

Soil name	Tomatoes		Sweet potatoes		Peppers		Sweet corn		Apples		Peaches	
	A	B	A	B	A	B	A	B	A	B	A	B
Atsion sand	----	----	----	----	----	----	----	----	----	----	----	----
Aura loamy sand, 0 to 5 percent slopes	4	7	3	5	5	7	2	4	2	4	3	6
Aura sandy loam, 0 to 2 percent slopes	6	8	4	6	6	8	4	6	2	4	3	6
Aura sandy loam, 2 to 5 percent slopes	6	8	4	6	6	8	4	6	2	4	3	6
Aura soils, ironstone variant, 0 to 5 percent slopes	4	6	3	5	----	----	3	4	----	----	----	----
Berryland sand	----	----	----	----	----	----	----	----	----	----	----	----
Berryland sand, flooded	----	----	----	----	----	----	----	----	----	----	----	----
Coastal beach-Urban land complex	----	----	----	----	----	----	----	----	----	----	----	----
Downer loamy sand, 0 to 5 percent slopes	3	5	3	5	3	6	2	3	2	4	2	6
Downer sandy loam, 0 to 2 percent slopes	4	8	4	6	4	8	3	5	2	4	3	6
Evesboro sand, 0 to 5 percent slopes	1	4	2	4	2	4	2	4	2	3	3	5
Evesboro sand, clayey substratum, 0 to 5 percent slopes	1	4	2	4	2	4	2	4	2	4	3	6
Fill land	----	----	----	----	----	----	----	----	----	----	----	----
Fill land over Tidal marsh	----	----	----	----	----	----	----	----	----	----	----	----
Fort Mott sand, 0 to 5 percent slopes	5	7	3	5	4	7	2	4	2	4	3	6
Hammonton loamy sand, 0 to 3 percent slopes	4	7	4	6	3	7	3	5	4	6	3	6
Hammonton loamy sand, clayey substratum, 0 to 2 percent slopes	4	7	4	6	3	7	3	5	4	6	2	6
Hammonton sandy loam, 0 to 2 precent slopes	4	7	4	6	4	7	3	5	4	6	2	6
Hammonton sandy loam, clayey substratum, 0 to 2 percent slopes	4	7	4	6	4	7	3	5	4	6	2	6
Klej loamy sand, 0 to 3 percent slopes	3	6	4	6	3	7	2	4	2	4	2	6
Klej loamy sand, clayey substratum, 0 to 3 percent slopes	3	7	4	6	3	7	2	4	2	4	2	6
Lakehurst sand, 0 to 3 percent slopes	----	----	----	----	----	----	----	----	----	----	----	----
Lakewood sand, 0 to 5 percent slopes	----	----	----	----	----	----	----	----	----	----	----	----
Lakewood sand, 5 to 10 percent slopes	----	----	----	----	----	----	----	----	----	----	----	----
Matawan sandy loam, 0 to 5 percent slopes	4	7	4	5	3	7	4	6	2	4	2	6
Muck	----	----	----	----	----	----	----	----	----	----	----	----
Pocomoke sandy loam	----	----	----	----	----	----	----	----	----	----	----	----
Sassafras sandy loam, 0 to 2 percent slopes	6	9	3	5	5	9	7	9	6	8	4	7
Sassafras sandy loam, 2 to 5 percent slopes	6	9	3	5	5	9	7	9	6	8	4	7
Tidal marsh, deep	----	----	----	----	----	----	----	----	----	----	----	----
Tidal marsh, moderately deep	----	----	----	----	----	----	----	----	----	----	----	----
Tidal marsh, shallow	----	----	----	----	----	----	----	----	----	----	----	----
Woodstown sandy loam, 0 to 2 percent slopes	4	7	3	5	4	9	4	7	5	7	2	6

TABLE 3.—*Conversion of ratings given in table 2 to yields per acre*

Rating	Tomatoes	Sweet potatoes	Peppers	Sweet corn	Apples	Peaches
	Tons	*Bu*	*Bu (30 lb)*	*100 ears (86 lb)*	*Bu*	*Bu*
1	8	100	150	65	275	175
2	10	125	200	70	300	200
3	12	150	250	75	325	225
4	14	175	300	80	350	250
5	16	200	350	85	375	275
6	18	225	400	90	400	300
7	20	250	450	95	425	325
8	22	275	500	100	450	350
9	24	300	550	105	475	375
10	26+	325+	600	110	500+	400+

is made up of soils that are suited to the same kinds of trees, that have the same potential production, and that need about the same management where the vegetation on them is similar.

Each woodland suitability group is identified by a three-part symbol, such as 2o1, 2w1, or 3s1. The potential productivity of the soils in the group is indicated by the first number in the symbol: 1, very high; 2, high; 3, moderately high; 4, moderate; and 5, low. These ratings are based on field determination of average site index of an indicator species. Site index of a given soil is the height, in feet, that the dominant and codominant trees reach in a natural, essentially unmanaged stand in 50 years. Site index (table 4) can be converted into approximate expected growth and yield per acre. For Atlantic County, conversions

TABLE 4.—*Yields per acre from upland oaks and Virginia pine in even-aged, fully stocked natural stands*

[All numbers are rounded to the nearest whole number]

Site index	Age of stand	Merchantable volume		
		Upland oaks		Virginia pine
	Years	*Cords* [1]	*Fbm* [2]	*Cords* [3]
40	30	3	100	6
	50	12	1,400	10
	70	21	4,250	12
50	30	6	350	11
	50	19	3,250	18
	70	30	8,150	21
60	30	10	850	19
	50	26	6,300	31
	70	39	12,800	33
70	30	15	1,750	33
	50	33	9,750	54
	70	47	17,700	56
80	30	20	3,350	57
	50	41	13,750	93
	70	56	23,100	106

[1] Unpeeled volume of merchantable items to a top diameter of 4 inches, outside bark.

[2] According to international rule, ⅛ inch, for stems to a top diameter of 5 inches, inside bark. (Fbm=board feet.)

[3] Merchantable volume of all stems 4 inches or more in diameter breast high and to a top diameter of 4 inches, outside bark, in stands of 100 percent density. Based on a conversion factor of 85 cubic feet equals 1 standard cord.

of average site index into volumetric growth and yield are based on research as follows: upland oaks (*10*), pitch pine (*4*), shortleaf pine (*13*), and Virginia pine (*14*).

The second part of the symbol identifying a woodland suitability group is a small letter: *w, s,* or *o.* Priority in placing each kind of soil in a subclass is determined by the order of the letters as listed above. Except for the letter *o,* the letter indicates an important soil property that imposes a hazard or limitation in managing the soils of the group for trees. The letter *w* means excessive wetness either seasonally of throughout the year. The letter *s* indicates dry, unstable, abrasive, sandy soils that have little or no difference in texture between the surface layer and subsoil. The letter *o* shows that the soils have slight or no limitations that restrict their use for trees.

The last part of the symbol, another number, differentiates groups of soils that have identical first and second parts in their identifying symbol. Soils in woodland suitability group 3w1, for example, require different management, or they are suited to other species of trees than soils in group 3w2 because of differences in soil properties or other factors.

In table 5 each woodland suitability group has a verbal rating for various management hazards or limitations. These ratings are slight, moderate, or severe, and they are described in the following paragraphs.

Erosion hazard refers to the potential hazard of soil losses in common woodland management operations. The hazard is slight if expected soil losses are small, moderate if some soil losses are expected and care is needed during logging and construction to reduce soil loss, and severe if special methods of operation are necessary to prevent excessive soil losses.

Equipment restrictions depend on soil characteristics that restrict or prohibit the use of harvesting equipment, either seasonally or continually. Slight means that no restrictions are imposed on the kind of equipment or the time of year it is used; moderate means that use of equipment is restricted for 3 months of the year or less; severe means that special equipment is needed and that its use is severely restricted for more than 3 months of the year.

Seedling mortality refers to mortality of naturally occurring or planted tree seedlings, as influenced by kinds of soil or topographic conditions when plant competition is assumed not to be a factor. Slight means a loss of 0 to 25 percent of the seedlings, moderate means a loss of 25 to 50 percent, and severe means a loss of more than 50 percent of the seedlings. It is assumed that seed supplies are adequate.

Plant competition is the degree to which undesirable plants invade openings in the tree canopy. Considered in the ratings are available water capacity, fertility, drainage, and degree of erosion. Slight means that plant competition does not prevent adequate natural regeneration and early growth or interfere with seedling development; moderate means that competition delays natural or artificial establishment and growth, but does not prevent the development of fully stocked normal stands; severe means that competition prevents adequate natural or artificial regeneration, unless the site is prepared properly and maintenance practices are used.

Windthrow hazard depends on the soil characteristics that enable trees to resist being blown down by wind. Slight means that most trees withstand the wind; moderate means that some trees are expected to blow down during periods of excessive wetness and high wind; severe means that many trees are expected to blow down during periods when the soils are wet and winds are moderate or high.

Table 5 also lists species to favor in existing stands and suitable species for planting. The estimated site index in table 5 is the average height, in feet, that the dominant and codominant trees reach at 50 years of age on the soils of each group. The site index applies to fully stocked, even-aged, unmanaged stands and is obtained by measuring trees on field plots of normally developed timber stands.

Wildlife [3]

The welfare of a wildlife species depends largely on the amount and distribution of food, shelter, and water (*1*). If any of these elements is missing, inadequate, or inaccessible, the species is absent or scarce. The kinds of wildlife that live in a given area and the number of each kind are closely related to land use, to the resulting kinds and patterns of vegetation, and to the supply and distribution of water. These, in turn, are generally related to the kinds of soils.

Habitat for wildlife normally can be created or improved by planting suitable vegetation, by properly managing the existing plant cover, by fostering the natural establishment of desirable plants, or by using a combination of these measures.

[3] By LAWRENCE ROBINSON, biologist, Soil Conservation Service.

TABLE 5.—*Woodland suitability groups, productivity*

[Coastal beach-Urban land complex (Cu), Fill land (FL), Fill land over Tidal marsh (FM), and Tidal marsh (TD), (TM), (TS), are less

Woodland suitability group, soil series, and map symbols	Species	Estimated site index	Suitable species— To favor in existing stands
		Feet	
Group 2o1 Hammonton: HaA, HcA, HmA, HnA. Matawan: MtA. Woodstown: WcA.	Oaks	75–85	Black oak and white oak
Group 2w1 Pocomoke: Po.	Oaks Sweetgum	75–85 85–95	Sweetgum, pin oak, willow oak, and white oak.
Group 3o1 Aura: AmB, ArA, ArB, AvB. Downer: DoA, DsA. Fort Mott: FrA. Sassafras: SaA, SaB.	Oaks	65–75	Virginia pine, white oak, and black oak
Groups 3s1 Evesboro: EwB. Klej: KmA, KnA.	Oaks	65–75	Virginia pine, black oak, and white oak
Group 3w1 Atsion: Ac. Berryland: Bp, BS.	Pitch pine	65–75	Pitch pine
Group 3w2 Muck: MU.	Atlantic white-cedar [1]	45–55	Atlantic white-cedar
Group 4s1 Evesboro: EvB. Lakehurst: LaA.	Pitch pine	55–65	Pitch pine
Group 5s1 Lakewood: LeB, LeC.	Pitch pine	<55	Pitch pine

[1] No curves have been developed for Atlantic white-cedar. (Information is based on best estimates.)

In this section the soils of Atlantic County are rated according to their suitability for six elements of wildlife habitat and for three kinds of wildlife. Subsequently explained in the section are the elements and classes of wildlife and the suitability ratings of the soils. The suitability ratings in this section can be used as an aid in:

1. Planning the broad use of parks, refuges, nature-study areas, and other recreational developments for wildlife.
2. Selecting the better soils for creating, improving, or maintaining specific kinds of wildlife habitat elements.
3. Determining the relative intensity of management needed for individual habitat elements.
4. Eliminating sites that would be difficult or not feasible to manage for specific kinds of wildlife.
5. Determining areas that are suitable for acquisition for use by wildlife.

Elements of wildlife habitat

Each soil is rated in table 6 according to its suitability for various kinds of plants and other elements that make up wildlife habitat. The elements considered important are presented in the following paragraphs.

Grain and seed crops. These crops include seed-producing annuals such as corn, sorghum, wheat, barley, oats, millet, buckwheat, sunflowers, and other plants commonly grown for grain or for seed. The major soil properties affecting this habitat element are effective rooting depth, available water capacity, natural drainage, slope, hazard of flooding, and texture of the surface layer and subsoil.

Grasses and legumes. Making up this group are domestic perennial grasses and herbaceous legumes that are established by planting and that furnish wildlife cover and food. Among the plants are bluegrass, fescue, brome, timothy, orchardgrass, reed canarygrass, clover, and alfalfa. The major soil properties affecting this habitat element are effective rooting depth, available water capacity, natural drainage, slope, surface stoniness, hazard of flooding, and texture of the surface layer and subsoil.

Wild herbaceous plants. In this group are native or introduced perennial grasses and weeds that generally are established naturally. They include bluestem, quackgrass, panicgrass, goldenrod, wild carrot, nightshade, pokeweed, and dandelion. They provide food and cover principally to upland forms of wildlife. The major soil properties affecting this habitat element are effective rooting depth, available water capacity, natural drainage, hazard of flooding or ponding, and texture of the surface layer and subsoil.

index, suitable species, and management concerns

not assigned to a woodland suitability group, because they do not produce harvestable stands of trees. The symbol < means than]

Suitable species—Continued	Management concerns				
For planting	Erosion hazard	Equipment restrictions	Seedling mortality	Plant competition	Windthrow hazard
Virginia pine and shortleaf pine	Slight	Slight	Slight	Moderate	Slight.
Pin oak and sweetgum	Slight	Severe	Severe	Severe	Severe.
Virginia pine and shortleaf pine	Slight	Slight	Moderate	Slight	Slight.
Virginia pine	Slight	Slight to moderate	Moderate	Moderate for conifers; slight for hardwoods.	Slight.
Pitch pine	Slight	Severe	Severe	Severe	Severe.
Not practical to plant in Muck	Slight	Severe	Slight	Severe	Severe.
Pitch pine, Virginia pine, and shortleaf pine.	Slight	Moderate	Severe	Slight	Slight.
Pitch pine, Virginia pine, and shortleaf pine.	Slight	Moderate	Severe	Slight	Slight.

Hardwood and coniferous trees. These include trees, shrubs, and woody vines that provide food and cover for wildlife in the form of browse, nuts, fruits, buds, catkins, twigs, seeds, or foliage. They are generally established naturally but in places are planted. Among the native kinds are oaks, pines, cherry, maple, American holly, apple, hawthorn, dogwood, sumac, redcedar, Atlantic white-cedar, sassafras, hickory, sweetgum, bayberry, blueberry, huckleberry, blackhaw, viburnum, grape, and briers. The major soil properties affecting this habitat element are effective rooting depth, available water capacity, natural drainage, and texture of the surface layer and subsoil.

Also in this group are several varieties of fruiting shrubs that are raised commercially for planting. Autumn olive, Amur honeysuckle, Tatarian honeysuckle, crabapple, multiflora rose, highbush cranberry, and silky cornel dogwood are some of the shrubs that generally are available and that can be planted on soils that are rated as well suited. Hardwoods that are not available commercially can commonly be transplanted successfully.

Wetland plants. Making up this group are wild, herbaceous, annual and perennial food and cover plants that grow on moist to wet sites, exclusive of submerged or floating aquatic plants. They produce food and cover used mainly by wetland forms of wildlife. They include smartweeds, wild millets, bulrushes, sedges, barnyard grass, duckweed, duckmillet, arrow-arum, pickerelweed, wetland grasses, wildrice, and cattails. The major soil properties affecting this habitat element are natural drainage, frequency of flooding or ponding, slope, and texture of the surface layer and subsoil.

Shallow-water areas. These are impoundments or excavations that provide areas of shallow water, generally not exceeding 5 feet in depth, near food and cover for wetland wildlife. Examples of such developments are shallow dugouts, level ditches, blasted potholes, and devices that keep the water at a depth of 6 to 24 inches in marshes. The major soil properties affecting this habitat element are natural drainage, slope, hazard of flooding, and soil permeability.

Farm ponds of the impounded, excavated, or dugout type are not considered as a habitat element. They can be important for recreational activities including fishing, however, and may also be a source of water for wildlife. If stocked with fish, such impoundments should be at least 6 feet deep over a large part of the area.

Kinds of wildlife

In table 6 the soils are rated according to their suit-

TABLE 6.—*Suitability of the soils for elements of wildlife habitat and kinds of wildlife*

[Coastal beach-Urban land complex (Cu), Fill land (FL), and Fill land over Tidal marsh (FM) are omitted because they are too variable to rate]

Soil series and map symbols	Elements of wildlife habitat						Kinds of wildlife		
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood and coniferous trees	Wetland plants	Shallow-water areas	Open land	Woodland	Wetland
Atsion: Ac	Poor	Poor	Fair	Fair	Poor	Good	Poor	Fair	Fair.
Aura:									
AmB, AvB	Poor	Fair	Good	Fair	Poor	Very poor.	Fair	Fair	Very poor.
ArA, ArB	Fair	Good	Good	Fair	Poor	Very poor.	Good	Fair	Very poor.
Berryland: Bp, BS	Very poor.	Poor	Poor	Poor	Poor	Good	Poor	Poor	Fair.
Downer:									
DoA	Poor	Fair	Good	Fair	Poor	Very poor.	Fair	Fair	Very poor.
DsA	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Evesboro: EvB, EwB	Poor	Poor	Fair	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Fort Mott: FrA	Poor	Fair	Fair	Poor	Poor	Very poor.	Fair	Poor	Very poor.
Hammonton:									
HaA, HcA	Poor	Fair	Good	Fair	Poor	Poor	Fair	Fair	Poor.
HmA, HnA	Fair	Good	Good	Fair	Poor	Poor	Good	Fair	Poor.
Klej: KmA, KnA	Poor	Fair	Fair	Poor	Poor	Poor	Fair	Poor	Poor.
Lakehurst: LaA	Poor	Poor	Fair	Poor	Poor	Fair	Poor	Poor	Poor.
Lakewood: LeB, LeC	Poor	Poor	Fair	Poor	Very poor.	Very poor.	Poor	Poor	Very poor.
Matawan: MtA	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.
Muck: MU	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
Pocomoke: Po	Very poor.	Poor	Poor	Poor	Good	Good	Poor	Poor	Good.
Sassafras: SaA, SaB	Good	Good	Good	Good	Poor	Very poor.	Good	Good	Very poor.
Tidal marsh: TD, TM, TS	Very poor.	Very poor.	Very poor.	Very poor.	Good	Good	Very poor.	Very poor.	Good.
Woodstown: WcA	Good	Good	Good	Good	Poor	Poor	Good	Good	Poor.

ability for three kinds of wildlife in the county—open land, woodland, and wetland.

Open land wildlife. Examples of open-land wildlife are quail, pheasants, meadowlark, field sparrow, doves, cottontail rabbit, red fox, and woodchuck. These birds and mammals normally make their home in areas of crops, pasture, meadow, and lawns and in areas overgrown with grasses, herbs, and shrubs.

Woodland wildlife. Among the birds and mammals that prefer woodland are ruffed grouse, woodcock, thrushes, vireos, scarlet tanager, gray and red squirrel, gray fox, white-tailed deer, and raccoon. They obtain food and cover in stands of hardwoods, coniferous trees, shrubs, or a mixture of these plants.

Wetland wildlife. Ducks, geese, rails, herons, shore birds, beaver, mink, and muskrat are familiar examples of birds and mammals that normally make their home in wet areas, such as ponds, marshes, and swamps.

Each rating under "Kinds of wildlife" in table 6 is based on the ratings listed for the habitat elements in the first part of the table. For open-land wildlife the

rating is based on the ratings shown for grain and seed crops, grasses and legumes, wild herbaceous upland plants, hardwood woody plants, and coniferous woody plants. The rating for woodland wildlife is based on the ratings listed for grasses and legumes, wild herbaceous upland plants, hardwood woody plants, and coniferous woody plants. For wetland wildlife the rating is based on the ratings shown for wetland food and cover plants, shallow-water developments, and excavated ponds.

In table 6 the soils are rated *good, fair, poor,* and *very poor.* On soils rated *good,* habitat is generally easily created, improved, or maintained. Few or no soil limitations in habitat management exist, and satisfactory results are well assured.

On soils rated *fair,* habitat usually can be created, improved, or maintained, but the soils have moderate limitations that affect the creation, improvement, or maintenance of the habitat. Moderately intensive management and fairly frequent attention may be required to assure satisfactory results.

On soils rated *poor,* habitat can usually be created, improved, or maintained, but there are rather severe soil limitations. Habitat management may be difficult or expensive and may require intensive effort. Satisfactory results are questionable.

On soils rated *very poor,* it is impractical to create, improve, or maintain habitat because of the very severe soil limitations. Unsatisfactory results are probable.

Not considered in the ratings are present land use, the location of a soil in relation to other soils, and the mobility of wildlife.

About 15 percent of the soils of Atlantic County are rated good for open-land habitat, 30 percent are rated fair for this use, 30 percent are rated poor, and 25 percent are rated very poor or are unrated. About 10 percent of the soils are rated good for woodland habitat, 35 percent are rated fair, 30 percent are rated poor, and 25 percent are rated very poor or are unrated. About 25 percent of the soils are rated good for wetland habitat, 10 percent are rated fair, 20 percent are rated poor, and 45 percent are rated very poor or are unrated.

Much of the Tidal marsh is included in the coastal salt meadows, type 16, rated important to waterfowl (*20*) by the U.S. Fish and Wildlife Service.

Engineering Uses of the Soils[4]

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissions, town and city managers, land developers, engineers, contractors, and farmers.

Among the soil properties that are highly important in engineering are permeability, strength, compaction characteristics, drainage condition, shrink-swell potential, grain size, plasticity, and reaction. Also important are depth to the water table and slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built to predict performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 7, 8, and 9, which show, respectively, several estimated soil properties significant to engineering; interpretations for various engineering uses; and results of engineering laboratory tests on soil samples.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in table 10 and also can be used to make other useful maps.

This information, however, does not eliminate the need for further investigation at sites selected for engineering works. Inspection of sites is needed because many delineated areas of a given mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some terms used in this soil survey have special meaning to soil scientists but may not be familiar to all engineers. The Glossary defines many of these terms commonly used in soil science.

Engineering soil classification systems

The two systems most commonly used in classifying samples of soils for engineering are the Unified system used by the SCS engineers, the Department of Defense (*3*), and others, and the AASHTO system adopted by the American Association of State Highway and Transportation Officials (*2*).

In the Unified system soils are classified according to particle-size distribution, plasticity, liquid limit, and organic matter. Soils are grouped in 15 classes—eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, CL–ML.

[4] DONALD HASLEM, engineer, Soil Conservation Service, helped prepare this section.

TABLE 7.—*Estimated soil properties*

[Absence of data indicates that the soil is too variable to be rated or that no

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	USDA texture [1]	Classification: Unified	Classification: AASHTO
	Feet	*Inches*			
Atsion: Ac	0–1	0–17	Sand	SP, SP–SM	A–3
		17–24	Sand	SP, SP–SM	A–3
		24–60	Sand	SP, SM, SM–SC	A–2, A–3
Aura:					
AmB, ArA, ArB	>5	0–12	Sandy loam	SM, SC	A–2, A–4
		12–48	Gravelly sandy clay loam	SM, SC, GM, GC	A–2, A–4
		48–72	Loamy sand and gravelly sand	SP–SM, SM, SC	A–2, A–4
AvB	>5	0–24	Loamy sand and sandy loam [4]	SP–SM, SM, SC	A–1, A–2, A–4
		24–36	Gravelly sandy clay loam	SM, SC, GM, GC	A–2, A–4
		36–60	Sandy loam	SM, SC	A–2
Berryland: Bp, BS	0	0–15	Sand	SP, SP–SM	A–1, A–3
		15–22	Loamy sand	SP, SP–SM	A–1, A–3
		22–64	Sand and gravelly sand	SP, SM, SC	A–2, A–3
Coastal beach-Urban land complex: Cu. Properties are for Coastal beach only.	1–5	0–60	Sand	SP	A–3
Downer: DoA, DsA	5	0–17	Loamy sand	SM	A–2, A–4
		17–33	Sandy loam	SM, SC	A–2, A–4
		33–60	Loamy sand and sand	SP, SM, SC	A–2, A–3
Evesboro:					
EvB	>5	0–36	Sand	SP, SP–SM	A–1, A–2, A–3
		36–60	Sand	SP, SM, SC, SM–SC	A–1, A–2, A–3
EwB	>5	0–40	Sand	SP, SP–SM	A–1, A–2, A–3
		40–60	Sandy clay	SC, CL, CH, SM, ML, MH	A–4, A–6, A–7
Fill land:					
FL	2–4	0–60	Sand and gravelly sand.		
FM	4–5	0–60	Sand and gravelly sand (5 feet of fill).		
Fort Mott: FrA	>5	0–25	Sand and loamy sand	SP–SM, SM	A–2
		25–41	Sandy loam	SM, SC	A–2, A–4
		41–60	Gravelly loamy sand	SM, SP–SM, SC	A–2, A–3
Hammonton:					
HaA, HmA	1½–4	0–18	Loamy sand	SM	A–2
		18–36	Sandy loam	SM, SC	A–2, A–4
		36–60	Sand	SP, SM, SM–SC	A–2, A–3
HcA, HnA	1½–4	0–18	Loamy sand	SM	A–2
		18–30	Sandy loam	SM, SC	A–2, A–4
		30–40	Sand	SP, SM	A–2, A–3
		40–60	Sandy clay	CL, CH, SC	A–4, A–6, A–7
Klej:					
KmA	1½–4	0–36	Loamy sand	SP, SM	A–2, A–3
		36–60	Sand	SP, SM, SM–SC	A–2, A–3
KnA	1½–4	0–40	Loamy sand	SP, SM	A–2, A–3
		40–60	Sandy clay	SC, CL, CH	A–4, A–6, A–7
Lakehurst: LaA	1½–4	0–39	Sand	SP, SP–SM	A–2, A–3
		39–60	Sand	SP, SM, SM–SC	A–1, A–2, A–3
Lakewood: LeB, LeC	>5	0–40	Sand	SP, SP–SM	A–1, A–2, A–3
		40–60	Sand	SP, SM, SM–SC	A–1, A–2, A–3

significant to engineering

estimate was made. The symbol > means greater than; the symbol < means less than]

Percentages less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permea-bility	Available water capacity	Reaction	Shrink-swell potential
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)						
						Inches per hour	*Inches per inch of soil*	*pH*	
95–100	90–100	55–90	2–10	----	----	6.0–20	[2] 0.06–0.08	3.6–4.4	Low.
95–100	90–100	55–90	2–10	[3] NP	NP	2.0–6.0	0.08–0.12	4.5–5.0	Low.
95–100	80–100	40–90	2–35	NP–25	NP–7	2.0–>6.0	0.04–0.10	4.5–5.0	Low.
80–100	80–100	40–80	20–40	----	----	2.0–6.0	0.10–0.14	3.6–4.4	Low.
60–100	50–100	30–80	25–50	20–40	5–15	0.2–2.0	0.08–0.12	4.5–5.0	Low.
70–100	60–100	35–80	10–40	NP–40	NP–12	2.0–6.0	0.04–0.10	4.5–5.0	Low.
85–100	80–100	40–100	10–40	----	----	0.6–6.0	0.08–0.14	3.6–4.4	Low.
60–100	50–100	40–80	25–50	20–40	5–15	0.2–2.0	0.08–0.12	4.5–5.0	Low.
70–100	60–100	40–70	20–35	NP–30	NP–10	2.0–6.0	0.04–0.10	4.5–5.0	Low.
95–100	90–100	55–90	2–10	----	----	6.0–20	[2] 0.06–0.08	3.6–4.4	Low.
95–100	90–100	55–90	2–10	NP	NP	2.0–6.0	0.08–0.12	4.5–5.0	Low.
95–100	70–100	40–90	2–30	NP–25	NP–7	>6.0	0.04–0.10	4.5–5.0	Low.
100	95–100	65–100	0–4	NP	NP	>6.0	0.02–0.04	6.6–7.3	Low.
80–100	75–100	50–90	15–35	----	----	0.6–6.0	0.10–0.16	3.6–4.4	Low.
80–100	55–100	40–90	20–40	NP–35	NP–10	0.6–6.0	0.10–0.14	4.5–5.0	Low.
65–100	55–100	25–90	0–30	NP–30	NP–7	2.0–>6.0	0.05–0.10	4.5–5.0	Low.
90–100	85–100	50–90	0–12	NP	NP	6.0–20	0.04–0.09	3.6–4.4	Low.
65–100	60–100	45–95	0–30	NP–25	NP–7	2.0–>6.0	0.04–0.10	4.5–5.0	Low.
90–100	85–100	50–90	0–12	NP	NP	6.0–20	0.04–0.09	3.6–4.4	Low.
90–100	85–100	60–100	45–70	15–50	5–15	<0.2	0.10–0.15	4.5–5.0	Moderate.
90–100	85–100	50–90	10–25	----	----	6.0–20	0.05–0.10	3.6–4.4	Low.
90–100	80–100	50–90	30–45	15–35	NP–15	0.6–6.0	0.12–0.16	4.5–5.0	Low.
90–100	70–100	40–90	5–30	NP–25	NP–7	6.0–20	0.05–0.10	4.5–5.0	Low.
80–100	75–100	50–90	15–35	----	----	2.0–6.0	[2] 0.10–0.16	3.6–4.4	Low.
80–100	55–100	40–90	20–40	10–35	NP–10	0.6–6.0	0.10–0.14	4.5–5.0	Low.
65–100	55–100	25–100	0–30	NP–25	NP–7	2.0–>6.0	0.05–0.10	4.5–5.0	Low.
80–100	75–100	50–90	15–35	----	----	2.0–6.0	[2] 0.10–0.16	3.6–4.4	Low.
80–100	55–100	40–90	20–40	10–35	NP–10	0.6–6.0	0.10–0.14	4.5–5.0	Low.
75–100	70–100	50–90	0–15	NP	NP	2.0–>6.0	0.05–0.10	4.5–5.0	Low.
95–100	95–100	70–100	50–70	30–50	10–30	<0.2	0.10–0.16	4.5–5.0	Moderate.
90–100	85–100	60–90	0–25	NP	NP–4	>6.0	[2] 0.05–0.09	3.6–4.4	Low.
85–100	80–100	60–90	0–35	NP–30	NP–8	>6.0	0.05–0.10	4.5–5.0	Low.
90–100	85–100	60–90	0–20	NP	NP–5	>6.0	[2] 0.05–0.09	3.6–4.4	Low.
90–100	85–100	60–100	45–70	15–50	5–15	<0.2	0.10–0.15	4.5–5.0	Moderate.
85–100	80–100	40–90	0–20	NP	NP	6.0–20	[2] 0.04–0.09	3.6–5.0	Low.
80–100	70–100	40–100	0–30	NP–30	NP–7	6.0–20	0.04–0.10	4.5–5.0	Low.
95–100	90–100	40–90	0–12	NP	NP	6.0–20	0.04–0.09	3.6–5.0	Low.
85–100	75–100	40–90	0–30	NP–20	NP–4	6.0–20	0.04–0.10	4.5–5.0	Low.

TABLE 7.—*Estimated soil properties*

Soil series and map symbols	Depth to seasonal high water table	Depth from surface	USDA texture [1]	Classification	
				Unified	AASHTO
	Feet	*Inches*			
Matawan: MtA	1½–3	0–40	Sandy loam	SM, SC	A–2, A–4
		24–60	Clay loam, sandy loam, sandy clay loam	SC, CL, ML, SM	A–2, A–4, A–6
Muck: [5] MU	0	0–36	Muck	Pt	---
		36–60	Sand, gravelly sand	SM, SP–SM	A–1, A–2, A–3
Pocomoke: Po	0	0–28	Sandy loam	SM, SM–SC	A–2, A–4
		28–60	Gravelly sand, sand	SP–SM, SM	A–2, A–3
Sassafras: SaA, SaB	>5	0–18	Sandy loam	SM, SC	A–2, A–4
		18–38	Sandy clay loam, sandy loam	SM, SC	A–2, A–4
		38–60	Loamy sand, gravelly sand	SP–SM, SM, SC	A–1, A–2, A–3
Tidal marsh: [6] TD, TM, TS. Too variable for reliable estimates to be made other than for water table.	0				
Woodstown: WcA	1½–4	0–10	Sandy loam	SM	A–2, A–4
		10–32	Sandy clay loam	SM, SC	A–2, A–4
		32–60	Loamy sand, sand	SP–SM, SM	A–2, A–3

[1] Texture shown in the USDA texture column is that of the representative profile described for the soil series. Other soil textures are in the paragraph following the description of the representative profile for each soil series in the section "Descriptions of the Soils." The Unified and AASHTO classifications reflect the ranges in texture, if any, that are referred to in the paragraph following the representative profile.

[2] Additional water is available seasonally for plants from the water table.

TABLE 8.—*Interpretations of*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—
	Topsoil	Sand and gravel	Road fill	Reservoir area
Atsion: Ac	Poor: low fertility; low available water capacity; seasonal high water table.	Fair for sand: high water table limits accessibility. Unsuitable for gravel.	Poor: high water table; SP and SM material.	Permeable substratum; seasonal high water table.
Aura:				
AmB, ArA, ArB	Fair for ArA and ArB: moderate content of gravel. Poor for AmB: too sandy.	Fair for sand below a depth of 4 feet: excess fines. Poor for gravel: excess fines.	Fair: more than 30 percent fines.	Moderately rapidly permeable below a depth of 4 feet.
AvB	Poor: too sandy; many fragments of stone.	Unsuitable: excess fines and fragments of stone.	Fair: more than 30 percent fines; stoniness.	Moderately rapidly permeable in substratum.
Berryland: Bp, BS	Poor: high water table limits accessibility; too sandy.	Fair for sand: excess fines; high water table limits accessibility. Unsuitable for gravel: hazard of frequent flooding on BS.	Poor: seasonal high water table limits accessibility; SP and SM material.	Seasonal high water table; permeable substratum.

significant to engineering—Continued

Percentages less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Shrink-swell potential
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)			*Inches per hour*	*Inches per inch of soil*	*pH*	
95–100	90–100	50–90	20–40	15–25	4–8	0.6–6.0	[2] 0.10–0.18	3.6–5.0	Low.
95–100	95–100	55–100	30–60	15–45	5–15	0.2–0.6	0.14–0.18	4.5–5.0	Moderate.
---------	---------	---------	---------	---------	---------	>6.0	[2] 0.30–0.35	3.6–4.4	Low.
90–100	70–100	40–80	5–30	NP–10	NP–4	>6.0	0.04–0.08	4.5–5.0	Low.
90–100	80–100	55–90	25–40	NP–20	NP–7	0.6–2.0	[2] 0.14–0.18	3.6–5.0	Low.
80–100	70–100	50–90	10–25	NP–20	NP–5	<6.0	0.06–0.10	4.5–5.0	Low.
90–100	80–100	60–100	25–40	---------	---------	0.6–2.0	0.10–0.14	3.6–4.4	Low.
85–100	80–100	50–100	25–50	15–40	5–15	0.6–2.0	0.12–0.18	4.5–5.0	Low.
70–100	60–100	30–100	10–30	NP–30	NP–10	<6.0	0.06–0.10	4.5–5.0	Low.
85–100	80–100	50–100	25–40	---------	---------	0.6–2.0	[2] 0.12–0.16	3.6–4.4	Low.
80–100	80–100	50–100	30–50	15–30	5–15	0.6–2.0	0.12–0.16	4.5–5.0	Low.
70–100	70–100	50–90	10–25	NP–20	NP–5	>6.0	0.06–0.10	4.5–5.0	Low.

[3] NP = nonplastic.
[4] Iron-cemented fragments of sandstone, ranging from 3 to 12 inches in thickness and length, make up 5 to 40 percent of this profile.
[5] Muck is frequently flooded.
[6] Daily tidal flooding on Tidal marsh.

engineering properties of the soils

Soil features affecting—Continued					
Embankment material	Excavated ponds	Drainage	Irrigation	Grassed waterways	Shallow excavations
Rapidly permeable; little cohesion; fair stability.	Seasonal high water table; rapid rate of recharge unless underlain by clay.	Seasonal high water table; moderately rapidly permeable; ditch banks collapse readily.	Seasonal high water table; rapid rate of infiltration; low available water capacity where drained.	Low fertility; low available water capacity where drained.	Seasonal high water table; vertical cuts cave readily.
Good stability and compaction; good resistance to piping.	Unsuitable: low water table.	Not needed -------	Restricted rooting depth; moderately slowly permeable.	Features favorable.	Firm subsoil.
Small amount of material; moderate content of stones.	Unsuitable: low water table.	Not needed -------	Stoniness ---------	Stoniness ---------	Stoniness.
Rapidly permeable: little cohesion; fair stability.	High water table; rapid rate of recharge; flooding hazard frequent in BS.	Seasonal high water table; moderately rapid permeability; outlets difficult to establish in places; subject to stream overflow on BS.	Seasonal high water table; rapid rate of infiltration; low available water capacity where drained.	Not needed --------	Seasonal high water table; vertical cuts cave readily; hazard of stream overflow; constantly high water table in BS.

TABLE 8.—*Interpretations of*

Soil series and map symbols	Suitability as a source of— Topsoil	Sand and gravel	Road fill	Soil features affecting— Reservoir area
Coastal beach-Urban land complex: Cu. Rating is for Coastal beach only.	Poor: too sandy; subject to soil blowing.	Good for sand. Unsuitable for gravel.	Good: needs binder	Unsuitable: hazard of coastal storms; rapidly permeable.
Downer: DoA, DsA	Good for DsA: gravel in places. Poor for DoA: too sandy.	Fair for sand below a depth of 30 inches: excess fines. Poor for gravel: excess fines.	Fair: more than 30 percent fines.	Rapidly permeable substratum; low water table.
Evesboro:				
EvB	Poor: too sandy	Fair for sand: excess fines. Unsuitable for gravel.	Good: mainly SP and SM material; needs binder in places.	Rapidly permeable
EwB	Poor: too sandy	Poor for sand: excess fines. Unsuitable for gravel.	Good to a depth of 40 inches: SP and SM material. Poor below a depth of 40 inches: more than 30 percent fines.	Slowly permeable substratum.
Fill land:				
FL [1]	Unsuitable: low available water capacity; low fertility.	Unsuitable: limited amount of material.	Unsuitable: limited amount of material.	Unsuitable
FM	Unsuitable: low available water capacity; low fertility.	Unsuitable: limited amount of material.	Unsuitable: limited amount of material.	Rapidly permeable fill material over silty and organic material.
Fort Mott: FrA	Poor: too sandy	Fair for sand below a depth of 3½ feet: excess fines. Unsuitable for gravel.	Fair: more than 30 percent fines; SP and SM material.	Rapidly permeable substratum.
Hammonton:				
HaA, HmA	Good for HmA: moderate content of gravel. Poor for HaA: too sandy.	Fair for sand below a depth of 3 feet: excess fines. Unsuitable for gravel.	Fair: more than 30 percent fines.	Rapid rate of seepage in summer.
HcA, HnA	Fair for HnA. Poor for HcA: too sandy.	Unsuitable for sand and gravel.	Fair: SP and SM material; more than 30 percent fines.	Slowly permeable substratum.
Klej:				
KmA	Poor: too sandy	Fair for sand: excess fines. Unsuitable for gravel.	Good: mainly SP and SM material; generally needs binder.	Rapidly permeable in summer.
KnA	Poor: too sandy	Unsuitable for sand and gravel.	Good to a depth of 40 inches: SP and SM material. Fair below a depth of 40 inches: more than 30 percent fines.	Slowly permeable substratum.

engineering properties of the soils—Continued

Soil features affecting—Continued					
Embankment material	Excavated ponds	Drainage	Irrigation	Grassed waterways	Shallow excavations
Rapidly permeable; little cohesion; piping hazard.	Hazard of coastal storms.	Not needed	Very low available water capacity; slow intake rate in places.	Not needed	Vertical cuts cave readily.
Fair stability; rapid rate of seepage.	Low water table	Not needed: low water table.	Moderate available water capacity; moderate intake rate.	Medium fertility; moderate available water capacity.	Vertical cuts cave readily.
Rapidly permeable; difficult to compact.	Deep to water table.	Not needed	Low available water capacity; rapid intake rate; low fertility.	Low available water capacity; low fertility.	Vertical cuts cave readily.
Loose, cohesionless sand to a depth of 40 inches; clayey below a depth of 40 inches.	Deep to water table.	Not needed	Low available water capacity; low fertility.	Low available water capacity; low fertility.	Vertical cuts cave readily.
Rapidly permeable material; difficult to compact.	Deep to water table.	Not needed	Low available water capacity; rapid intake rate.	Low available water capacity; low fertility.	Vertical cuts cave readily.
Rapidly permeable fill material over silty and organic material.	Subject to hazard of coastal storms.	Not needed where fill material is deep.	Low available water capacity of fill material.	Generally not needed.	Vertical cuts cave readily.
Rapidly permeable surface layer and substratum.	Low water table	Not needed	Rapid intake rate; low available water capacity in upper 25 inches.	Low fertility; low available water capacity in upper 25 inches.	Conditions favorable.
Pervious surface layer and C horizon.	Low water table in summer, recharge rate where clay is thick.	Moderately or moderately rapidly permeable.	Moderate available water capacity; moderately high seasonal water table.	Moderate fertility; moderate available water capacity.	Vertical cuts cave readily; moderately high seasonal water table.
SP and SM material to a depth of 40 inches; CL, ML, and CH material below a depth of 40 inches.	Low water table in summer.	Moderately or moderately rapidly permeable to a depth of 40 inches; slowly permeable below a depth of 40 inches.	Moderately high seasonal water table; moderate available water capacity.	Moderate available water capacity; moderate fertility.	Vertical cuts cave readily; moderately high seasonal water table.
Fair to poor stability; rapidly permeable.	Low water table in summer.	Rapidly permeable; seasonal high water table at a depth of 1½ to 4 feet, low water table in summer.	Low available water capacity; rapid intake rate; low water table in summer.	Low fertility; low available water capacity; moderately high seasonal water table, low in summer.	Vertical cuts cave readily; seasonal high water table at a depth of 1½ to 4 feet in winter, below a depth of 5 feet in summer.
SP and SM material to a depth of 40 inches; CL, ML, and CH material below a depth of 40 inches.	Low water table in summer.	Rapidly permeable to a depth of 40 inches; slowly permeable below a depth of 40 inches.	Moderately high seasonal water table; low available water capacity.	Low available water capacity; low fertility.	Vertical cuts cave readily; moderately high seasonal water table.

TABLE 8.—*Interpretations of*

Soil series and map symbols	Suitability as a source of—			Soil features affecting—
	Topsoil	Sand and gravel	Road fill	Reservoir area
Lakehurst: LaA	Poor: too sandy; subject to soil blowing.	Fair for sand: excess fines. Unsuitable for gravel.	Good: needs binder	Rapidly permeable throughout; moderately high seasonal water table.
Lakewood: LeB, LeC	Poor: very low fertility; low available water capacity.	Fair for sand: excess fines. Unsuitable for gravel.	Good: needs binder	Rapidly permeable; low water table.
Matawan: MtA	Good	Unsuitable for sand and gravel: excess fines.	Fair: more than 30 percent fines.	Substratum permits seepage in places.
Muck: MU	Poor: upper layer of organic material; high water table hinders excavation.	Unsuitable for sand above a depth of 3 feet, fair or poor below: high water table hinders excavation; excess fines. Unsuitable for gravel.	Unsuitable above a depth of 3 feet: organic material. Poor below a depth of 3 feet: high water table hinders excavation.	High water table
Pocomoke: Po	Poor: high water table limits accessibility.	Fair for sand below a depth of 2½ feet: seasonal high water table. Unsuitable for gravel.	Poor: seasonal high water table limits accessibility; SP and SM material.	High water table; pervious substratum.
Sassafras: SaA, SaB	Good: gravel in places.	Fair for sand below a depth of 3 feet: excess fines. Poor for gravel.	Fair: more than 30 percent fines.	Seepage likely in substratum.
Tidal marsh: TD, TM, TS.	Unsuitable: difficult to excavate because of high water; subject to flooding twice daily; becomes extremely acid in places when dry.	Unsuitable: subject to daily tidal flooding.	Poor: subject to daily tidal flooding.	Subject to daily tidal flooding; hazard of storm tide.
Woodstown: WcA	Good	Fair for sand below a depth of 32 inches: excess fines; moderately high seasonal water table. Poor for gravel.	Fair: more than 30 percent fines.	Moderately high seasonal water table; substratum permits seepage in places.

[1] Ratings are highly generalized. Onsite investigation is needed because of variability of material.

The AASHTO system is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system a soil is placed in one of seven basic groups ranging from A–1 through A–7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A–1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A–7, are clay soils that have low strength when wet and are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A–1, A–2, and A–7 groups are divided as follows: A–1–a, A–1–b, A–2–4, A–2–5, A–2–6, A–2–7, A–7–5, and A–7–6. Within each group the relative engineering value of a soil material can be indicated by a group index number. Group indexes range from 0

engineering properties of the soils—Continued

Soil features affecting—Continued					
Embankment material	Excavated ponds	Drainage	Irrigation	Grassed waterways	Shallow excavations
Piping hazard; rapidly permeable.	Water table generally below a depth of 5 feet in summer.	Rapidly permeable	Low available water capacity; very low fertility.	Very low fertility; low available water capacity.	Moderately high seasonal water table; vertical cuts cave readily.
Rapidly permeable; difficult to compact; poor resistance to piping.	Low water table	Not needed	Low available water capacity; very low fertility.	Low available water capacity; very low fertility.	Vertical cuts cave readily.
Fair stability; fair to good compaction.	Small supply of water is perched on subsoil during winter and spring.	Moderately slowly permeable in subsoil.	Perching because of moderately slowly permeable subsoil.	Favorable	Favorable.
Highly organic material is unstable.	Favorable	High water table; outlets difficult to establish.	High water table; rapid intake rate; high available water capacity.	Not needed	High water table; vertical cuts cave; low bearing capacity.
Good stability and compaction to a depth of 2½ feet; rapidly permeable material below a depth of 2½ feet; little cohesion; surface layer highly organic.	Rapid rate of recharge.	Outlets difficult to establish; moderately permeable in upper 2½ feet, rapidly permeable below.	High water table; moderate available water capacity where drained.	High water table	High water table; vertical cuts cave readily.
Good stability and compaction; rapidly permeable substratum; little cohesion in substratum.	Low water table	Not needed	High available water capacity; moderate intake rate.	Favorable	Favorable.
Subject to daily tidal flooding; piping hazard; difficult to compact.	Subject to daily tidal flooding; hazard of storm tide.	Subject to daily tidal flooding; becomes extremely acid in places when dry.	Not needed	Not needed	Subject to daily tidal flooding; hazard of storm tide.
Good stability and compaction to a depth of 3 feet; rapidly permeable and cohesionless substratum.	Water table drops to a depth of 5 feet or more in summer.	Moderately permeable above substratum; rapidly permeable in substratum.	High available water capacity; moderate intake rate; moderately permeable; moderately high seasonal water table.	Moderately high seasonal water table.	Moderately high seasonal water table.

for the best material to 20 or more for the poorest. The AASHTO classification for tested soils, with group index numbers, is shown in table 9; the estimated classification, without group index numbers, is given for all soils mapped in the survey area in table 7.

USDA texture is determined by the relative proportions of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Sand," "silt," "clay," and some of the other terms used in the USDA textural classification are defined in the Glossary.

Soil properties significant to engineering

Several estimated soil properties significant in engineering are given in table 7. These estimates are made for typical soil profiles, by layers sufficiently different to have different significance for soil engi-

TABLE 9.—*Engineering*

[Tests made by the Engineering Department, Rutgers, the State University. Absence of data

Soil or land type	Sampling site			Test results			
					Sieve analysis		
					Cumulative percentage passing—		
	Site number	Latitude	Longitude	Depth	¾-inch	No. 4 (4.7 mm)	No. 10 (2.0 mm)
				Inches			
Atsion sand (Modal)	63	74°47′2″	39°04′8″	0–8	---	---	100
				8–22	---	---	100
				22–48	100	98	96
Aura sandy loam (Modal)	57	74°57′10″	39°32′00″	0–12	97	86	82
				12–24	96	85	80
				24–60	100	86	79
				60–120	---	100	91
Berryland sand (Modal)	61	74°32′31″	39°33′38″	0–12	100	99	99
				12–16	---	---	---
				16–36	98	96	96
				36–42	100	99	96
Coastal beach (Modal)	69	74°22′37″	39°24′06″	0–22	---	---	100
				22–36	100	96	94
				36–54	---	---	100
	70	74°23′22″	39°23′20″	0–8	100	99	99
				8–48	---	---	100
				48–60	---	---	100
	72	74°31′20″	39°18′52″	0–12	100	96	92
				12–28	100	99	98
				28–64	---	100	99
Downer loamy sand (Modal)	42	74°36′19″	39°20′47″	0–6	---	100	99
				6–28	---	---	100
				28–36	100	93	89
				36–60	99	95	95
				60–74	100	97	95
Evesboro sand (Modal)	45	74°44′35″	39°25′28″	0–18	---	100	99
				18–36	96	89	85
				36–56	100	95	89
				56–64	98	88	72
				64–76	99	93	83
	46	74°46′47″	39°25′24″	0–42	---	100	99
				42–56	100	93	91
				56–64	99	96	94
				64–74	99	99	97
Evesboro sand (Nonmodal) Fines slightly higher than modal.	54	74°39′28″	39°34′33″	0–4	---	100	98
				4–30	99	98	95
				30–38	82	67	63
Fort Mott sand (Modal)	58	74°54′35″	39°28′23″	0–30	100	96	94
				30–48	100	99	98
				48–52	100	95	91
Klej loamy sand (Nonmodal) Finer substratum nearer to the surface than modal.	35	74°44′42″	39°35′46″	0–26	100	98	97
				26–36	98	96	93
				36–84	---	100	99
Klej loamy sand (Nonmodal) Slightly lower content of fine sand than modal.	32	74°41′05″	39°30′02″	0–44	100	98	97
				44–56	100	99	94
				56–72	100	99	94
Lakehurst sand (Modal) Mainly coarse sand; low in fine sand.	67	74°45′30″	39°41′32″	0–6	---	100	99
				6–30	---	100	99
				30–96	---	100	99

test data

indicates determination was not made or that smaller sieve has passed 100 percent of material]

Test results—Continued								Classification		
Sieve analysis—Continued		Hydrometer analysis [1]						AASHTO		
Cumulative percentage passing—Continued										
No. 40 (0.42 mm)	No. 200 (0.074 mm)	0.05–0.005 mm	0.005 mm	Liquid limit [2]	Plasticity index [3]	Maximum density [4]	Optimum moisture content [4]	Group	Group index	Unified
		Percent	*Percent*	*Percent*		*Pounds per cubic foot*	*Percent*			
66	2	---	---	[5] NL	[6] NP	---	---	A-3	0	SP
64	2	---	---	NL	NP	107	13	A-3	0	SP
53	3	---	---	NL	NP	112	14	A-3	0	SP
56	20	---	---	NL	NP	---	---	A-2-4	0	SM
56	30	15	15	19	7	---	---	A-2-4	0	SM-SC
59	33	6	27	42	17	---	---	A-2-7	1	SM-SC
70	15	---	---	NL	NP	---	---	A-2-4	0	SM
74	9	---	---	NL	NP	---	---	A-3	0	SP-SM
73	13	---	---	NL	NP	---	---	A-2-4	0	SM
88	4	---	---	NL	NP	---	---	A-3	0	SP
96	1	---	---	NL	NP	---	---	A-3	0	SP
86	0	---	---	NL	NP	104	12	A-3	0	SP
99	0	---	---	NL	NP	101	16	A-3	0	SP
97	1	---	---	NL	NP	---	---	A-3	0	SP
99	0	---	---	NL	NP	103	13	A-3	0	SP
99	0	---	---	NL	NP	102	11	A-3	0	SP
66	1	---	---	NL	NP	---	---	A-3	0	SP
94	2	---	---	NL	NP	---	---	A-3	0	SP
99	1	---	---	NL	NP	---	---	A-3	0	SP
70	21	---	---	NL	NP	---	---	A-2-4	0	SM
79	25	---	---	NL	NP	117	11	A-2-4	0	SM
69	22	---	---	NL	NP	---	---	A-2-4	0	SM
57	11	---	---	NL	NP	121	8	A-2-4	0	SP-SM
56	21	---	---	NL	NP	---	---	A-2-4	0	SM
82	11	---	---	NL	NP	---	---	A-2-4	0	SP-SM
69	12	---	---	NL	NP	---	---	A-2-4	0	SP-SM
73	12	---	---	NL	NP	---	---	A-2-4	0	SP-SM
53	11	---	---	NL	NP	---	---	A-2-4	0	SP-SM
60	26	---	---	17	5	---	---	A-2-4	0	SM
62	7	---	---	NL	NP	119	11	A-3	0	SP-SM
56	6	---	---	NL	NP	117	10	A-3	0	SP-SM
50	18	---	---	NL	NP	---	---	A-2-4	0	SM
59	19	0	19	27	8	115	13	A-2-4	0	SM
81	14	---	---	NL	NP	---	---	A-2-4	0	SM
81	16	---	---	NL	NP	115	10	A-2-4	0	SM
53	15	---	---	NL	NP	122	10	A-2-4	0	SM
57	11	---	---	NL	NP	---	---	A-2-4	0	SP-SM
66	27	1	26	34	12	118	14	A-2-6	1	SM-SC
45	23	0	22	36	11	122	12	A-2-6	1	SM-SC
84	17	---	---	NL	NP	108	12	A-2-4	0	SM
86	18	---	---	NL	NP	108	12	A-2-4	0	SM
97	25	---	---	NL	NP	103	13	A-2-4	0	SM
56	7	---	---	NL	NP	---	---	A-3	0	SP-SM
41	8	---	---	NL	NP	---	---	A-1-b	0	SP-SM
37	10	---	---	NL	NP	---	---	A-1-b	0	SP-SM
47	2	---	---	NL	NP	---	---	A-1-b	0	SP
50	1	---	---	NL	NP	109	10	A-1-b	0	SP
36	0	---	---	NL	NP	107	14	A-1-b	0	SP

TABLE 9.—*Engineering*

Soil or land type	Sampling site: Site number	Sampling site: Latitude	Sampling site: Longitude	Test results: Depth	Sieve analysis — Cumulative percentage passing—: ¾-inch	No. 4 (4.7 mm)	No. 10 (2.0 mm)
				Inches			
Lakewood sand (Modal)	44	74°42′58″	39°23′19″	0–10			100
				10–30			100
				30–84			100
	62	74°41′10″	39°34′06″	0–4	100	99	95
				4–40		100	99
				40–54			100
				54–72	96	86	84
Sassafras sandy loam (Nonmodal)	53	74°30′38″	39°27′47″	0–8	96	83	81
Content of gravel higher than that in modal.				8–30	94	71	67
				30–100	99	94	85

[1] Standard Method AASHTO Designation T 88–49.
[2] Standard Method AASHTO Designation T 89–49.
[3] Standard Method AASHTO Designation T 91–49.

neering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Explanations of some of the columns in table 7 are given in the following paragraphs.

The soils in the county are deep enough over bedrock to prevent bedrock from affecting their use.

Depth to seasonal high water table is the distance from the surface of the soil to the highest level that water reaches in the soil in most years.

Soil texture is described in table 7 in the standard terms used by the Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, as for example, "gravelly loamy sand." "Sand," "silt," "clay, and some of the other terms used in USDA textural classification are defined in the Glossary of this soil survey.

Liquid limit and *plasticity index* indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a semisolid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material changes from the semisolid to plastic state; and the liquid limit, from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic. Liquid limit and plasticity index are estimated in table 7, but in table 9 the data on liquid limit and plasticity index are based on tests of soil samples.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on the basis of those soil characteristics observed in the field, particularly structure and texture. The estimates in table 7 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

Available water capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crop plants. Research supporting these estimates was done by the New Jersey Agricultural Experiment Station, Cook College, Rutgers, the State University (*7*).

Reaction is the degree of acidity or alkalinity of a soil, expressed in pH values. The pH value and terms used to describe soil reaction are explained in the Glossary. In this column the "natural," or unlimed, reactions are given.

Shrink-swell potential is the relative change in volume to be expected of soil material when the moisture content changes; that is, the extent to which the soil shrinks as it dries or swells when it gets wet. The extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A *high* shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material having this rating.

Engineering interpretations of the soils

The estimated interpretations in table 8 are based on the engineering properties of soils shown in table 7, on test data for soils in this survey area and others

test data—Continued

Test results—Continued								Classification		
Sieve analysis—Continued		Hydrometer analysis [1]						AASHTO		
Cumulative percentage passing—Continued										
No. 40 (0.42 mm)	No. 200 (0.074 mm)	0.05–0.005 mm	0.005 mm	Liquid limit [2]	Plasticity index [3]	Maximum density [4]	Optimum moisture content [4]	Group	Group index	Unified
		Percent	*Percent*	*Percent*		*Pounds per cubic foot*	*Percent*			
64	3	----------	----------	NL	NP	----------	----------	A–3	0	SP
69	2	----------	----------	NL	NP	----------	----------	A–3	0	SP
48	0	----------	----------	NL	NP	----------	----------	A–1–b	0	SP
74	6	----------	----------	NL	NP	----------	----------	A–3	0	SP-SM
80	8	----------	----------	NL	NP	----------	----------	A–3	0	SP-SM
81	1	----------	----------	NL	NP	----------	----------	A–3	0	SP
57	2	----------	----------	NL	NP	----------	----------	A–3	0	SP
69	30	----------	----------	NL	NP	----------	----------	A–2–4	0	SM
52	32	16	16	24	7	----------	----------	A–2–4	0	SM-SC
75	28	15	12	26	9	----------	----------	A–2–4	0	SC

[4] Standard Method AASHTO Designation T 99–49.
[5] NL=nonliquid.
[6] NP=nonplastic.

nearby or adjoining, and on the experience of engineers and soil scientists with the soils of Atlantic County. In table 8 ratings are used to summarize the limitation or suitability of the soils for all listed purposes other than for drainage of cropland and pasture, irrigation, ponds and reservoirs, embankments, and diversions. For these particular uses, table 8 lists those soil features not to be overlooked in planning installation and maintenance.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, when preparing a seedbed; natural fertility of the material, or the response of plants when fertilizer is applied; and absence of substance toxic to plants. Texture of the soil material and its content of stone fragments are characteristics that affect suitability. Also considered in the ratings is damage that results in the area from which topsoil is taken.

Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 8 provide guidance about where to look for probable sources. A soil rated as a *good* or *fair* source of sand or gravel generally has a layer at least 3 feet thick, the top of which is within a depth of 6 feet. The ratings do not take into account thickness of overburden, location of the water table, or other factors that affect mining of the materials, and neither do they indicate quality of the deposit. Washing of the sand is assumed necessary where the fines are excessive.

Road fill is soil material used in embankments for roads. The suitability ratings reflect the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and the relative ease of excavating the material at borrow areas.

Soil properties that most affect highway and road location are load-supporting capacity and stability of the subgrade and the workability and quantity of cut-and-fill material available. The AASHTO and Unified classifications of the soil material and the shrink-swell potential indicate traffic-supporting capacity. Wetness and flooding affect stability of the material. Wetness affects ease of excavation and amount of cut and fill needed to reach an even grade. Frost-action potential was not used as a limitation criteria in this county because most of the county has a freezing index of less than 250 degree-days (*17*).

Reservoir areas (of ponds) hold water behind a dam or embankment. Soils suitable for reservoir areas have low seepage, which is related to their permeability.

Embankment material (and dike material) must be resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. Presence of organic material in a soil is an unfavorable factor.

Excavated ponds are those constructed by excavation into ground water.

Drainage of soil is affected by such soil properties as permeability, texture, structure, depth to claypan or other layers that influence rate of water movement, depth to the water table, slope, stability of ditchbanks, susceptibility to flooding, salinity and alkalinity, and availability of outlets for drainage.

Irrigation is affected by such features as slope, susceptibility to flooding, hazards of water erosion and soil blowing, texture, presence of salts and alkali, depth of root zone, rate of water intake at the surface, permeability of the soil below the surface layer, available water capacity, need for drainage, and depth to the water table.

Grassed waterways are constructed to channel runoff at nonerosive velocities to outlets. Features that

affect the use of soils for waterways are slope, permeability, erodibility, and suitability for permanent vegetation.

Shallow excavations are used for pipelines, sewerlines, telephone and power transmission lines, basements, open ditches, and cemeteries. Such digging or trenching is influenced by the soil wetness of a high seasonal water table, the texture and consistence of soils, the tendency of soils to cave in or slough, and the presence of very firm, dense soil layers, bedrock, or large stones. In addition, excavations are affected by slope of the soil and the probability of flooding. Ratings do not apply to soil horizons below a depth of 6 feet unless otherwise noted.

In the soil series descriptions, the consistence of each soil horizon is defined, and the presence of very firm or extremely firm horizons, usually difficult to excavate, is indicated.

Test data

Table 9 contains engineering test data for some of the major soil series in Atlantic County. These tests were made to help evaluate the soils for engineering purposes. The engineering classifications given are based on data obtained by mechanical analyses and by tests to determine liquid limits and plastic limits. The mechanical analyses were made by combined sieve and hydrometer methods. All engineering test data in this survey are from sampling and testing by the College of Engineering, Rutgers, the State University (*6*), (*9*).

Moisture-density or compaction data are important in earthwork. If a soil material is compacted at successively higher moisture content, assuming that the compactive effort remains constant, the density of the compacted material increases until the *optimum moisture content* is reached. After that, density decreases with increase in moisture content. The highest dry density obtained in the compactive test is termed *maximum dry density*. As a rule, maximum strength of earthwork is obtained if the soil is compacted to the maximum dry density.

Tests to determine liquid limit and plastic limit measure the effect of water on the consistence of soil material.

Town and Country Planning

This section is mainly for planners, developers, zoning officials, landowners, and prospective landowners. It indicates the relative suitability of each soil in the county for various community developments (*11*). Planners and zoning officials who are interested in comparing the suitability of soils for town and country planning with their suitability for use in farming will also be interested in the section "Capability grouping" in this soil survey. Readers needing more information about the soil mapping units should refer to the section "Descriptions of the Soils."

The name and map symbol of each soil and land type are shown alphabetically in table 10. The soils are rated according to their degree of limitations for the various uses. For moderate and severe ratings in the table, the main cause of the limitation is listed. Fill land units are not rated in table 10 because they are too variable.

The uses rated in table 10 are for foundations of dwellings with and without basements; septic tank absorption fields; sanitary landfills; local roads and streets; lawns, landscaping, and golf fairways; athletic fields; picnic and play areas; campsites, trailers and tents; and paths and trails.

Limitations that affect community developments are rated *slight, moderate,* or *severe.* A rating of *slight* means that few or no significant limitations exist, and one of *moderate* means that one or more limitations exist that can normally be overcome at moderate cost by careful design and construction. *Severe* means that one or more limitations exist that cannot be overcome without considerable cost. A severe limitation does not imply that the soil is unsuitable, but rather that development costs are abnormally high.

Listed in the following paragraphs are the uses for which the soils are rated in table 10 and the major soil properties affecting the uses.

Foundations for dwellings with basements. Imporant soil properties include slope, natural soil drainage, and hazard of flooding.

Foundations for dwellings without basements. Important soil properties are the same as for dwellings, with basements, but the requirements are not as severe.

Septic-tank absorption fields. Important soil properties are permeability, natural drainage, slope, and hazard of flooding (*8*). Pollution of streams or wells is a hazard in rapidly permeable soils, but the possibility of this contamination was not considered when determining the rating for the interpretations. The ratings do not eliminate the need for percolation tests. The soil map and the ratings combined, however, give a basis for making and interpreting the tests. The soil map shows, for example, the areas in which ground water is likely to prevent free drainage of a septic field during part of the year. In such areas a percolation test in summer, when the water table is deep, does not give the information needed to judge the site.

Sanitary landfill. The primary factors in rating limitations of soils for this use are slope, natural drainage, hazard of flooding, and texture of the soil and permeability of the substratum. Onsite investigation is needed to determine limitations below a depth of 5 feet. Soils that are rapidly permeable in the substratum have poor filtering properties and are rated severe because of the hazard of stream and well pollution.

Local roads and streets. The primary factors for rating the limitations of soils for streets and parking lots are in the depth to water table, slope, and hazard of flooding. Frost-action potential was not used as a limitation criteria in this county, because most of the county has a freezing index of less than 250 degree-days (*17*).

Lawns, landscaping, and golf fairways. The primary factors in rating the limitations for lawns, landscaping, and golf fairways are natural fertility, available water capacity, natural drainage, and slope.

Athletic fields. The primary factors in rating the limitations of soils for athletic fields are slope, natural drainage, and texture.

Picnic and play areas. Picnic and play areas are

listed together, because they have similar soil requirements. The primary factors in rating the limitations of soils for these uses are depth to the water table, slope, and texture.

Campsites (trailers and tents). The soil features important for rating campsites are hazard of flooding, depth to water table, texture of the surface layer, and slope.

Paths and trails. Important features used for rating paths and trails are depth to water table, hazard of flooding, and texture of the surface layer.

Landscape Planting

This section gives information about some of the trees and shrubs suitable for landscaping home, school, industrial, and recreational areas. In planning, consideration should be given to wind protection, screening of unsightly areas, and the general beauty of neighborhoods.

Trees and shrubs of different species vary widely in suitability for different soils and site conditions (*18*). The soils in the county are placed in four landscape groups, mainly on the basis of the amount of wetness from seasonal high water tables and their available water capacity.

Each of the soils in a specific group has similar suitability for tree and shrub plantings. The landscape planting group of each soil is listed in the "Guide to Mapping Units" at the back of this soil survey. No landscape planting group has been assigned to Coastal beach-Urban land complex, the Fill land units, and the Tidal marsh units.

Only a partial listing of the plants suited to soils in the county are given in table 11. Plants that have severe weaknesses because of disease, insects, or other problems are not included (*11*). Many of the plants serve a dual purpose of landscaping and of providing food and cover for wildlife. If more detail is needed and pertinent landscaping plans are desired, landowners and others should communicate with local agricultural agencies and with local landscape specialists.

Listed in table 11 are the soils making up the landscaping groups, their map symbols, and the suggested plants suitable for planting on each landscape group of soils.

Formation and Classification of the Soils

The factors of soil formation in Atlantic County are discussed in the first part of this section, and the processes by which soil horizons develop are discussed in the second part. In the latter part of the section the soils of the county are classified according to the current system.

Factors of Soil Formation

Soils form through the interaction of five major factors: parent material, climate, plant and animal life, relief, and time. The relative influence of each factor may vary from place to place. Local variations in soils are mostly because of differences in kinds of parent material or relief. In each place soil properties reflect the dominance of one or more of the above factors.

Parent material

All of the soils of Atlantic County formed in unconsolidated geologic material many feet thick. The most extensive deposit is the Cohansey Formation (*5*). It underlies nearly all of the county but is buried by thin, more recent deposits in much of the county. The parent material is composed mainly of quartz sand, locally with lenses or thin strata of light-colored clay or gravel. The Bridgeton Formation is also extensive. It is a more gravelly and clayey deposit. It occurs as reddish deposits that cap the hills and upland areas (surficial deposits). The Bridgeton Formation was at one time nearly continuous but has been eroded. It remains as isolated remnants on the summits. The Cape May Formation is in valleys and lowlands near the coast at elevations of 40 to 50 feet. It is made up of material eroded locally from the Bridgeton and Cohansey Formations and lesser amounts of other materials.

Climate

The climate and relief of Atlantic County are closely interrelated. The climatic changes during and after the Ice Age had considerable effect on the soils. Glacial melt water caused much erosion and mixing of soil materials. The degree and kind of weathering of the Bridgeton deposits suggests that there were periods of warmer climate than the climate of today.

Plant and animal life

Micro-organisms, plants, and many higher organisms influence the formation of soils by adding organic matter. Higher plants tend to offset leaching by feeding on nutrients in the rooting zone and depositing them on the surface in the form of leaves, twigs, and dead plants. Micro-organisms hasten the decay of organic matter and, when they die, add to the organic residue. Many animals, such as crawling insects, moles, and worms, chew up plant remains and mix them into the soil. By burrowing into the soil they improve aeration and permeability.

In the process of decay many organic substances are released, among them humic acids, which accelerate weathering of mineral grains and leaching of nutrients.

In areas where pine trees and the associated plants and micro-organisms have dominated the biological community for a long time are soils that have bleached horizons. In this county frequent burning has played a role in maintaining the pine forest. For this reason soils like those of the Lakewood, Lakehurst, and Atsion series are in frequently burned areas.

Relief

In this county the most significant effect of relief has been on soil drainage. The upland areas typically have steep enough slopes to permit runoff and cause erosion. In lowland areas the soils have been affected by slower runoff and deposition of sediment.

TABLE 10.—*Degree and kind of limitations*

Soil series and map symbols	Foundations for dwellings—		Septic-tank absorption fields	Sanitary landfill
	With basements	Without basements		
Atsion: Ac	Severe: seasonal high water table at a depth of 0 to 12 inches.	Severe: seasonal high water table at a depth of 0 to 12 inches.	Severe: seasonal high water table at a depth of 0 to 12 inches.	Severe: seasonal high water table at a depth of 0 to 12 inches.
Aura:				
AmB, ArA, ArB	Slight	Slight	Moderate: moderately slow to moderate permeability in subsoil; deep excavation to permeable material needed in most places.	Slight
AvB	Moderate: stone content.	Slight: stone content	Moderate: stone content.	Slight: stone content
Berryland: Bp, BS	Severe: seasonal high water table at surface; hazard of frequent stream overflow on BS.	Severe: seasonal high water table at surface; hazard of frequent stream overflow on BS.	Severe: seasonal high water table at surface; hazard of frequent stream overflow on BS.	Severe: seasonal high water table at surface; hazard of frequent stream overflow on BS.
Coastal beach-Urban land complex: Cu. Ratings are for Coastal beach only.	Severe: subject to coastal storm flooding; high water table in places.	Severe: subject to coastal storm flooding; high water table in places.	Severe: subject to coastal storm flooding; hazard of ground-water pollution because of rapid permeability.	Severe: subject to coastal storm flooding; lacks filter material.
Downer: DoA, DsA	Slight	Slight	Slight: hazard of ground-water pollution.	Severe: low amount of filter material; rapid permeability in substratum.
Evesboro: EvB. EwB	Slight	Slight	Slight for EvB: hazard of ground-water pollution in places because of rapid permeability. Severe for EwB: slow permeability in substratum.	Severe for EvB: rapid permeability. Slight for EwB.
Fort Mott: FrA	Slight	Slight	Slight: hazard of ground-water pollution in places because of rapid permeability.	Severe: low amount of filter material; hazard of ground-water pollution because of rapid permeability in substratum.
Hammonton: HaA, HcA, HmA, HnA.	Moderate: seasonal high water table at a depth of 1½ to 4 feet.	Slight: seasonal high water table at a depth of 1½ to 4 feet.	Moderate: moderately well drained; drainage needed.	Severe: seasonal high water table at a depth 1½ to 4 feet.
Klej: KmA, KnA	Moderate: seasonal high water table at a depth of 1½ to 4 feet.	Slight: seasonal high water table at a depth of 1½ to 4 feet.	Moderate for KmA: seasonal high water table at a depth of 1½ to 4 feet; drainage needed. Severe for KnA: slow permeability in substratum.	Severe: seasonal high water table at a depth of 1½ to 4 feet.

of the soils for town and country uses

Local roads and streets	Lawns, landscaping, and golf fairways	Athletic fields	Picnic and play areas	Campsites (trailers and tents)	Paths and trails
Severe: seasonal high water table at a depth of 0 to 12 inches.	Severe: seasonal high water table at a depth of 0 to 12 inches; low fertility.	Severe: water table above a depth of 20 inches during season of use.	Severe: water table above a depth of 20 inches during season of use.	Severe: water table above a depth of 20 inches during season of use.	Severe: water table above a depth of 20 inches during season of use.
Slight	Slight for ArA and ArB. Moderate for AmB: too sandy.	Slight for ArA and ArB. Moderate for AmB: dust hazard.	Slight for ArA and ArB. Moderate for AmB: dust hazard.	Slight for ArA and ArB. Moderate for AmB: dust hazard.	Slight for ArA and ArB. Moderate for AmB: dust hazard.
Slight: stone content.	Moderate: moderate available water capacity; medium fertility; stone content.	Severe: many stones.	Moderate: dust hazard.	Moderate: dust hazard.	Moderate: dust hazard.
Severe: seasonal high water table at surface; hazard of frequent stream overflow on BS.	Severe: seasonal high water table; low fertility; low available water capacity where drained; hazard of frequent stream overflow on BS.	Severe: seasonal high water table at surface; hazard of frequent stream overflow on BS.	Severe: water table above a depth of 20 inches during season of use.	Severe: water table above a depth of 20 inches during season of use; hazard of frequent stream overflow on BS.	Severe: water table above a depth of 20 inches during season of use; hazard of frequent stream overflow on BS.
Severe: subject to coastal storm flooding.	Severe: low fertility; low available water capacity; subject to soil blowing.	Severe: low available water capacity; low fertility; subject to soil blowing.	Severe: dust hazard.	Severe: dust hazard.	Severe: dust hazard.
Slight	Slight for DsA. Moderatea for DoA; sandy surface soil, dust hazard.	Slight for DsA. Moderate for DoA: sandy surface soil.	Slight for DsA. Moderate for DoA: dust hazard.	Slight for DsA. Moderate for DoA: dust hazard.	Slight for DsA. Moderate for DoA: dust hazard.
Slight	Severe: low fertility; low available water capacity.	Severe: low fertility; low available water capacity; dust hazard.	Severe: dust hazard.	Severe: dust hazard.	Severe: dust hazard.
Slight	Severe: low fertility; moderate available water capacity.	Severe: dust hazard; low fertility.	Severe: dust hazard; moderate available water capacity; low fertility.	Severe: dust hazard.	Severe: dust hazard.
Severe: seasonal high water table at a depth of 1½ to 4 feet.	Slight for HmA and HnA. Moderate for HaA and HcA: medium fertility.	Moderate: water table below a depth of 20 inches during season of use; too sandy on HaA and HcA.	Slight for HmA and HnA. Moderate for HaA and HcA: dust hazard.	Slight for HmA and HnA. Moderate for HaA and HcA: dust hazard.	Slight for HmA and HnA. Moderate for HaA and HcA: dust hazard.
Moderate: seasonal high water table at a depth of 1½ to 4 feet.	Severe: low fertility; low available water capacity; subject to soil blowing.	Severe: dust hazard; low available water capacity; low natural fertility.	Severe: dust hazard.	Severe: dust hazard.	Moderate: dust hazard.

TABLE 10.—*Degree and kind of limitations of*

Soil series and map symbols	Foundations for dwellings— With basements	Foundations for dwellings— Without basements	Septic-tank absorption fields	Sanitary landfill
Lakehurst: LaA	Moderate: seasonal high water table at a depth of 1½ to 4 feet.	Slight	Moderate: moderately well drained; drainage needed; hazard of ground-water pollution.	Severe: seasonal high water table at a depth of 1½ to 4 feet; hazard of ground-water pollution because of rapid permeability.
Lakewood: LeB, LeC	Slight	Slight	Slight: hazard of ground-water pollution because of rapid permeability.	Severe: low amount of filter material; hazard of ground-water pollution because of rapid permeability.
Matawan: MtA	Moderate: seasonal water level at a depth of 1½ to 3 feet.	Slight	Severe: moderately slow permeability.	Moderate: diversion of surface water from trench needed; onsite investigation needed to determine depth of ground water.
Muck: MU	Severe: high water table; hazard of flooding; low bearing capacity.	Severe: high water table; hazard of flooding; low bearing capacity.	Severe: high water table; hazard of flooding.	Severe: high water table; low bearing capacity; hazard of flooding.
Pocomoke: Po	Severe: seasonal high water table at surface.	Severe: seasonal high water table at surface.	Severe: seasonal high water table at surface.	Severe: seasonal high water table at surface; limited amount of filter material.
Sassafras: SaA, SaB	Slight	Slight	Slight: hazard of pollution because of rapid permeability in substratum.	Severe: hazard of ground-water pollution because of rapid permeability in substratum.
Tidal marsh: TD, TM, TS.	Severe: subject to daily tidal flooding and coastal storm flooding; low bearing capacity.	Severe: subject to daily tidal flooding and coastal storm flooding.	Severe: subject to daily tidal flooding.	Severe: subject to daily tidal flooding.
Woodstown: WcA	Moderate: seasonal high water table at a depth of 1½ to 4 feet.	Slight: seasonal high water table at a depth of 1½ to 4 feet.	Moderate: moderately well drained; deep drainage needed.	Severe: seasonal high water table at a depth of 1½ to 4 feet; low content of filter material.

For long periods while the soils were forming, low areas were saturated or covered with water. The soils that formed in these places have accumulations of organic matter in the form of a dark-colored surface horizon. They also have a gray subsoil as a result of poor aeration. The upland soils were generally better drained. Strong-brown and reddish colors indicate adequate aeration and the presence of iron oxide. Relationship of texture of the subsoil to natural drainage characteristics is shown for soil series in table 12.

Time

The formation of soils takes a long time. Imperceptible changes are taking place continuously, but their cumulative effect is noticeable only after hundreds, perhaps thousands, of years.

The geologic materials exposed in Atlantic County are for the most part tens of thousands of years old. The oldest soils are those on the remnants of the Bridgeton Formation capping the hills. These soils are deeply weathered and have distinct horizons. Other upland soils are younger but nevertheless have well-developed horizons. The soils of the Cape May deposits are younger and have less distinct profiles. Along the streams in low areas, the soils formed in comparatively recent deposits, and profiles are indistinct.

the soils for town and country uses—Continued

Local roads and streets	Lawns, landscaping, and golf fairways	Athletic fields	Picnic and play areas	Campsites (trailers and tents)	Paths and trails
Moderate: seasonal high water table at a depth of 1½ to 4 feet.	Severe: very low fertility; low available water capacity; subject to soil blowing.	Severe: dust hazard; seasonal high water table at a depth of 1½ to 4 feet; very low fertility.	Severe: dust hazard.	Severe: dust hazard.	Severe: dust hazard.
Slight for LeB. Moderate for LeC: hazard of erosion.	Severe: very low fertility; low available water capacity; low organic-matter content.	Severe: low available water capacity; very low fertility; severe dust hazard.	Severe: low available water capacity; very low fertility; severe dust hazard.	Severe: dust hazard.	Severe: dust hazard.
Moderate: moderate shrink-swell potential.	Slight	Moderate: perching over subsoil because of moderately slow permeability in subsoil.	Moderate: perching over subsoil because of moderately slow permeability in subsoil.	Moderate: surface ponding because of moderately slow permeability in subsoil.	Slight: moderately high water level in winter and spring.
Severe: high water table; hazard of flooding; low bearing capacity.	Severe: high water table; hazard of flooding; low bearing capacity.	Severe: high water table: hazard of flooding.	Severe: high water table; hazard of flooding.	Severe: high water table; hazard of flooding.	Severe: high water table; hazard of flooding; low bearing capacity.
Severe: seasonal high water table at surface.	Severe: seasonal high water table at surface.	Severe: seasonal high water table at surface.	Severe: water table above a depth of 20 inches for 1 month or more during season of use.	Severe: water table above a depth of 20 inches for 1 month or more during season of use.	Severe: water table above a depth of 20 inches for 1 month or more during season of use.
Slight	Slight	Slight	Slight	Slight	Slight.
Severe: subject to daily tidal flooding.	Severe: subject to daily tidal flooding.	Severe: subject to daily tidal flooding.	Severe: subject to daily tidal flooding.	Severe: subject to daily tidal flooding.	Severe: subject to daily tidal flooding.
Moderate: more than 30 percent fines in subgrade.	Slight: seasonal high water table at a depth of 1½ to 4 feet.	Moderate: water table below a depth of 20 inches during season of use.	Slight: water table below a depth of 20 inches during season of use.	Slight: water table below a depth of 20 inches during season of use.	Slight: water table below a depth of 20 inches during season of use.

Development of Soil Horizons

In most places soil formation begins by the weathering of rock or parent material to reduce it to smaller particles. In the Coastal Plain this process took place before the marine or melt-water deposits were laid down; consequently, chemical weathering and clay mineral formation are more important than the weathering of rock to parent material. Processes common to soils of the Coastal Plain are freezing and thawing, wetting and drying, heating and cooling, and shrinking and swelling. These processes are largely responsible for breaking pebbles and grains into smaller particles and for development of soil structure.

In the Coastal Plain, soil formation is mostly the result of accumulation of organic residue in the surface horizons; leaching of the products of weathering and decay; chemical weathering of primary minerals and formation of secondary or clay minerals; and translocation of silicate clay minerals, silt particles, and probably humus and iron or aluminum oxide complexes from one horizon to another. In most soils several or all of these processes are operating at the same time. Laboratory test data for 51 profiles sampled and tested are available (*19*).

The newer manmade soils (Fill land, for example) have the least accumulation of organic matter in the

TABLE 11.—*Landscape*

[Dashes indicate no

Landscape planting group, soil series, and map symbols	Deciduous trees		
	Suitable species and potential height[1] of large- and medium-sized trees having—		
	Rapid rate of growth	Moderate rate of growth	Slow rate of growth
Group 1: well-drained soils that have high or moderate available water capacity: Aura: AmB, ArA, ArB, AvB. Downer: DoA, DsA. Fort Mott: FrA. Sassafras: SaA, SaB.	White ash (50+), cutleaf European birch (50), American linden (50+), mimosa (25–40), American mountainash (25–50), northern red oak (50+), Bradford pear (40–50), silverbell (50+), sweetgum (50+), yellow-poplar (50–100), yellowwood (50+), zelkova (50+), and katsura (50–75).	Green ash (40–60), European beech (50+), gray birch (15–25), flowering crabapple (15–25), crapemyrtle (20–35), ginkgo (50+), golden chaintree (30), blackgum (25–50), red haw (20–30), thornless honeylocust (40–70), American hornbeam (25–35), red horse chestnut (30–40), Japanese pagoda (50+), kalopanax (50+), sweetbay magnolia (15–25), Norway maple (40–80), Norway maple (named varieties, 15–70), red maple (40–80), sugar maple (60–75), pin oak (50+), scarlet oak (50+), shingle oak (75+), southern red oak (50+), turkey oak (75+), willow oak (50+), plums and cherries (15–40), and shadbush (20–35).	American beech (50+), flowering dogwood (25), golden raintree (20–40), European hornbeam (50+), ironwood (20–50), littleleaf linden (30), and white oak (50+).
Group 2: moderately well-drained or somewhat poorly drained soils that have a seasonal high water table: Hammonton: HaA, HcA, HmA, HnA. Klej: KmA, KnA. Lakehurst: LaA. Matawan: MtA. Woodstown: WcA.	White ash (50+), cutleaf European birch (50), katsura (50–75), American linden (50+), mimosa (25–40), American mountainash (25–50), northern red oak (50+), Bradford pear (40–50), sweetgum (50+), and yellow-poplar (50–100).	Green ash (40–60), European beech (50+), gray birch (15–25), crapemyrtle (20–35), blackgum (25–50), thornless honeylocust (40–70), American hornbeam (25–35), red horse chestnut (30–40), Japanese pagoda (50+), kalopanax (50+), European larch (50+), sweetbay magnolia (15–25), Norway maple (40–80), Norway maple (named varieties, 15–70), red maple (40–80), sugar maple (60–75), pin oak (50+), scarlet oak (50+), shingle oak (75+), southern red oak (50+), turkey oak (75+), willow oak (50+), and shadbush (20–35).	American beech (50+), flowering dogwood (25), ironwood (20–50), littleleaf linden (30), and white oak (50+).
Group 3: Poorly drained or very poorly drained soils that have a high water table for more than 6 months: Atsion: Ac. Berryland: Bp, BS. Pocomoke: Po.	Sweetgum (50+)	Blackgum (25–50), European larch (50+), sweetbay magnolia (15–25), red maple (40–80), pin oak (50+), and willow oak (50+).	White oak (50+)
Group 4: excessively drained (droughty) sandy soils that have low available water capacity: Evesboro: EvB, EwB. Lakewood: LeB, LeC.	Mimosa (25–40) and zelkova (50+).	Gray birch (15–25), American hornbeam (25–35), and turkey oak (75+).	Ironwood (20–50)

[1] Potential height, in feet, is shown in parentheses.
[2] Many species.

planting guide

suitable plants]

Deciduous trees—Continued	Evergreen trees			
Suitable species and potential height [1] of small trees and shrubs	Suitable species and potential height [1] of trees having—			Suitable species and potential height [1] of shrubs
	Rapid rate of growth	Moderate rate of growth	Slow rate of growth	
Arrowwood (10–15), flame azalea (10–15), bayberry (6–10), blackhaw (15–20), coralberry (2–6), highbush cranberry (10–15), redosier dogwood (10), Laland firethorn (10–20), forsythia (10–15), Franklin tree (15–20), hawthorns (12–20), Amur honeysuckle (10–15), Tatarian honeysuckle (10–15), maples (sp)[2] (12–25), autumn-olive (10–15, Amur privet (15–20), winterberry (10), and white fringe tree (12–15).	Glossy privet (30–40)	Cedar of Lebanon (50–80+), eastern redcedar (30+), cryptomeria (80–100+), white fir (50–100), eastern hemlock (50–90), southern magnolia (50+), Austrian pine (50+), white pine (50–100), Norway spruce (50+), and white spruce (50+).	Northern white-cedar (50+), oriental white-cedar (50+), Atlas cedar (50+), California incense cedar (50–90), American holly (30–50), and Colorado blue spruce (50+).	Azalea (5–10), Chinese holly (10), Japanese holly (variable), juniper (sp) (variable), mountain-laurel (5–15), mugo pine (10), rhododendron (10–15), and Japanese yew (variable).
Arrowwood (10–15), bayberry (6–10), blackhaw (15–20), coralberry (2–6), highbush cranberry (10–15), redosier dogwood (10), maples (sp) (12–25), winterberry (10), and white fringe tree (12–15).	Glossy privet (30–40)	Eastern redcedar (30+), eastern hemlock (50–90), Austrian pine (50+), white pine (50–100), Norway spruce (50+), and white spruce (50+).	Northern white-cedar (50+), oriental white-cedar (50+), and American holly (30–50).	Juniper (sp) (variable), mountain-laurel (5–15), and rhododendron (10–15).
Arrowwood (10–15), redosier dogwood (10), winterberry (10), and white fringe tree (12–15).		White spruce (50+)		
Autumn-olive (10–15)		Austrian pine (50+) and white pine (50–100).		

TABLE 12.—*Soil series arranged according to subsoil texture and natural drainage*

Dominant texture of the subsoil and other selected properties	Natural drainage class					
	Excessively drained	Well drained	Moderately well drained	Somewhat poorly drained	Poorly drained	Very poorly drained
Sand or loamy sand:						
Bleached horizon more than 6 inches thick.	Lakewood	----------	Lakehurst	Lakehurst	Atsion	Berryland.
Bleached horizon less than 6 inches thick.	Evesboro	----------	Klej	Klej	----------	----------
Sandy loam with surface layer of loamy sand up to 20 inches thick, or sandy loam.	----------	Downer	Hammonton	Hammonton	----------	Pocomoke.
Sandy clay loam or sandy loam:						
Surface layer of loamy sand more than 20 inches thick.	----------	Fort Mott	----------	----------	----------	----------
Surface layer of sandy loam that has a brownish mottled and friable subsoil.	----------	Sassafras	Woodstown	----------	----------	----------
Surface layer of sandy loam or loamy sand less than 20 inches thick that has a reddish and firm subsoil.	----------	Aura	----------	----------	----------	----------
Clay loam ----------	----------	----------	Matawan	----------	----------	----------
Mixed mineral or muck in upper 20 inches:						
Mostly mineral material.	----------	----------	----------	----------	----------	Tidal marsh.
Mostly organic material.	----------	----------	----------	----------	----------	Muck.

surface layer. Sandy soils, such as those of the Evesboro, Klej, Lakewood, and Lakehurst series have a surface layer that is less than 1 percent organic matter. Sassafras soils and other loamy, well-drained soils have a surface layer that is 1 to 4 percent organic matter, and Pocomoke and Berryland soils and other very poorly drained soils have one that is 5 to 10 percent.

Except in the Tidal marsh soils, leaching of bases has been so severe that all the soils are naturally extremely acid or very strongly acid. Heavy liming of the farmed fields has changed the reaction in these soils to a depth of 3 to 4 feet.

Translocation of the clay minerals from one layer to another occurs in Downer and Sassafras soils. The subsoil of these soils has 3 to 10 percent more clay than either the surface layer or the underlying layers.

Various chemical changes and iron transfer are common to many soils of Atlantic County. The effects of oxidation and iron transfer are probably most striking in the Lakehurst soils, which have a strongly bleached, gray surface layer and a yellowish-brown subsoil. Present in places is a Bh horizon that contains organic matter and iron.

Iron is transferred in the wet soils where iron is segregated in mottles. Iron concretions are common in Lakehurst, Atsion, and Berryland soils. Iron is reduced in soils that are wet for long periods. Most soils of this kind are gray, because the iron is reduced instead of being oxidized. Examples are Pocomoke soils, which have a gray subsoil.

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about the soils, to see their relationships to one another and to the whole environment, and to develop principles that help us to understand their behavior and their response to manipulation. First through classification, and then through use of soil maps, we can apply our knowledge of soils to specific fields and other tracts of land.

The narrow categories of classification, such as those used in detailed soil surveys, allow us to organize and apply knowledge about soils in managing farms, fields, and woodland; in developing rural areas; in engineering work; and in many other ways. Soils are placed in

broad classes to facilitate study and comparison in large areas, such as countries and continents.

The system of soil classification currently used was adopted by the National Cooperative Soil Survey in 1965 (*16*). Because this system is under continual study, readers interested in developments of the current system should search the latest literature available.

The current system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, sub-group, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar genesis, or mode of origin, are grouped. In table 13 the soil series of Atlantic County are placed in four orders of the current system. Classes of the current system are briefly defined in the following paragraphs.

Order. Ten soil orders are recognized in the current classification system. Of these ten, only Entisols, Histosols, Spodosols, and Ultisols occur in Atlantic County. The properties used to differentiate among soil orders are those that tend to give broad climatic groupings of soils. The two exceptions to this are the Entisols and Histosols, which occur in many different climates. Each order is named with a word of three or four syllables ending in *sol* (Ult-i-sol).

Suborder. Each order is subdivided into suborders that are based primarily on those soil characteristics that seem to produce classes with the greatest genetic similarity. The suborders narrow the broad climatic range permitted in the orders. The soil properties used to separate suborders are mainly those that reflect either the presence or absence of waterlogging, or soil differences resulting from the climate or vegetation. The names of suborders have two syllables. The last syllable indicates the order. An example is *Aquult* (*Aqu*, meaning water or wet, and *Ult*, from Ultisol).

Great group. Soil suborders are separated into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used to make separations are those in which clay, iron, or humus have accumulated; those that have pans that interfere with growth of roots, movement of water, or both; and thick, dark-colored surface horizons. The features used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), dark-red and dark-brown colors associated with basic rocks, and the like. The names of great groups have three or four syllables and are made by adding a prefix to the name of the suborder. An example is Umbraquults (*Umbr*, meaning thick, dark-colored surface soil, *aqu* for wetness or water, and *Ult*, from Ultisols).

Subgroup. Great groups are subdivided into subgroups, one of which represents the central (typic) segment of the group. The other subgroups, called intergrades, have properties of one great group and also one or more properties of another great group, suborder, or order. Subgroups may also be made in those instances where soil properties intergrade outside of the range of any other great group, suborder, or order. The names of subgroups are derived by placing one or more adjectives before the name of the great group. An example is Typic Umbraquults (a typical Umbraquult).

Family. Soil families are separated within a subgroup primarily on the basis of properties important to the growth of plants or on the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reactions, soil temperature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, and so on, that are used as family differentiae (table 13). An example

TABLE 13.—*Soil series and land types classified according to current system of classification*

Soil series and land types	Family	Subgroup	Order
Soil series:			
Atsion	Sandy, siliceous, mesic	Aeric Haplaquods	Spodosols.
Aura	Fine-loamy, mixed, mesic	Typic Hapludults	Ultisols.
Berryland	Sandy, siliceous, mesic	Typic Haplaquods	Spodosols.
Downer	Coarse-loamy, siliceous, mesic	Typic Hapludults	Ultisols.
Evesboro	Mesic, coated	Typic Quartzipsamments	Entisols.
Fort Mott	Loamy, siliceous, mesic	Arenic Hapludults	Ultisols.
Hammonton	Coarse-loamy, siliceous, mesic	Aquic Hapludults	Ultisols.
Klej	Mesic, coated	Aquic Quartzipsamments	Entisols.
Lakehurst	Mesic, coated	Haplaquodic Quartzipsaments	Entisols.
Lakewood	Mesic, coated	Spodic Quartzipsamments	Entisols.
Matawan	Fine-loamy, siliceous, mesic	Aquic Hapludults	Ultisols.
Pocomoke [1]	Coarse-loamy, siliceous, thermic	Typic Umbraquults	Ultisols.
Sassafras	Fine-loamy, siliceous, mesic	Typic Hapludults	Ultisols.
Woodstown	Fine-loamy, siliceous, mesic	Aquic Hapludults	Ultisols.
Land types [2]:			
Fill land	----------	Typic Quartzipsamments	Entisols.
Muck	----------	----------	Histosols.
Tidal marsh	----------	----------	Entisols.

[1] Soil temperature is a few degrees cooler than defined for the series.

[2] Coastal beach and Urban land are not listed because they were not classified according to taxonomy. Dashes indicate that the land type was not classified at that level of taxonomy.

is the coarse-loamy, siliceous, thermic family of Typic Umbraquults.

Series. Soil series are separated within a family. Each series is a collection of individual soils having essentially uniform properties and sequences of horizons or layers within a defined depth. An example is the Pocomoke series.

Climate[5]

Atlantic County has a humid and temperate climate. The coastal area is influenced substantially by the tempering effects of the ocean. The county has no other physiographic features that influence climate.

Temperature and precipitation data are given in table 14. These data are for a 19-year period. Since weather conditions are frequently cyclic, variations should be expected depending on the 10-year period selected. Temperatures inland in Hammonton and Buena are higher in summer and lower in winter than those in the area adjacent to the ocean at Atlantic City. The highest temperature that was recorded at Hammonton is 104° F, and the highest at Atlantic City is 99° F. The lowest temperature that was recorded at Hammonton is −13° F, and the lowest at Atlantic City is −7° F. The effect of the ocean is evident if temperatures of more than 90° and less than 32° at Hammonton are compared with those at Atlantic City. Hammonton has an average of 35 days a year that have temperatures of more than 90° and 102 days that have temperatures of less than 32°. Atlantic City has 4 days that have temperatures of more than 90° and 69 days that have temperatures of less than 32°.

In the interior of the county soils freeze for short periods, especially where they are bare, but are frozen less than half of the time in winter. As a rule temperatures are not low long enough to freeze the soil deeply. Frost-action potential is not a concern close to the shore and is only a slight concern inland, particularly where soils have surface layers of sand or loamy sand.

The highest annual rainfall at Atlantic City was 68.34 inches in 1948, and the lowest was 30.14 inches in 1918. Monthly rainfall averages throughout the county indicate rather even distribution per month, the highest monthly rainfall occurring in July and August. Thunderstorms bring much of the summer rain. Nearly every year, however, there are periods when rainfall is inadequate for the high-value crops that are grown in the county. Irrigation is used for nearly all high-value crops.

At Atlantic City the maximum rainfall for 1 hour was 1.95 inches in 1906 and the maximum for 24 hours was 9.21 inches in 1903. The maximum rainfall for 3 days was 10.66 inches in August 1879.

Wind affects crop production in the county. Most winter winds and winds early in spring blow from the northwest. On the average, wind duration and velocity are greatest in March. By this time, most cover crops are plowed down in fields used for early crops. Sand blown by high winds cuts young corn and similar unprotected plants. High winds also remove organic matter, a valuable part of sandy soils.

The length of the growing season is 192 days. The average date of the last killing frost is May 7, and that of the first in fall is October 2. Probabilities for the last damaging cold temperature in spring and the first in fall are listed in table 15.

Coastal storms occur along the shore more than once a year. They are the result of hurricanes or northeastern storms. Average tides are 2 feet above mean sea level. High tides in storms, however, are as much as 8 feet above mean sea level. As a rule tides remain

[5] By DONALD V. DUNLAP, former climatologist for New Jersey, National Weather Service, U.S. Department of Commerce.

TABLE 14.—*Temperature and precipitation*

[Snow data are from Atlantic City; all other data are from Hammonton]

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with— Maximum temperature higher than—	Two years in 10 will have at least 4 days with— Minimum temperature lower than—	Average monthly total	One year in 10 will have— Less than—	One year in 10 will have— More than—	Days with snow cover 1 inch or more	Average depth of snow on days with snow cover
	°F	*°F*	*°F*	*°F*	*Inches*	*Inches*	*Inches*	*Number*	*Inches*
January	43	25	55	5	2.9	0.8	4.8	4	4
February	45	25	58	19	3.3	1.9	5.3	4	4
March	52	32	70	21	4.0	1.5	6.4	2	3
April	65	40	83	30	3.5	1.9	5.9	(1)	2
May	75	50	90	38	3.5	1.0	6.7	0	0
June	84	59	96	50	3.3	.9	5.7	0	0
July	88	64	98	60	4.6	1.0	9.4	0	0
August	86	62	94	53	4.9	1.2	10.2	0	0
September	80	55	92	43	3.4	.7	7.7	0	0
October	70	45	82	33	3.1	1.4	5.2	0	0
November	58	36	69	25	3.7	1.4	6.7	(1)	3
December	46	26	62	13	3.9	1.9	8.0	2	3
Year	66	43	[2] 99	[3] 2	44.1	36.0	59.0	12	4

[1] Less than one-half day.
[2] Average annual highest maximum.
[3] Average annual lowest minimum.

TABLE 15.—*Probabilities of last freezing temperatures in spring and first in fall*

[All data are from Hammonton]

Probability	Dates for given probability and temperature				
	16° F or lower	20° F or lower	24° F or lower	28° F or lower	32° F or lower
Spring:					
1 year in 10 later than	March 21	April 1	April 10	April 25	May 7
2 years in 10 later than	March 16	March 26	April 3	April 19	May 2
5 years in 10 later than	March 2	March 10	March 21	April 6	April 21
Fall:					
1 year in 10 earlier than	November 19	November 12	October 31	October 15	October 2
2 years in 10 earlier than	November 25	November 17	November 5	October 20	October 6
5 years in 10 earlier than	December 7	November 28	November 17	October 31	October 16

high for 1 or 2 cycles. At the time of the March 1962 coastal storm, however, tides remained high for 5 cycles. Waves during storms, of course, are considerably higher than the tide.

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Glossary

Acidity. See Reaction, soil.

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

Bleached horizon. A horizon near the surface in which the peds are so devoid of coatings that the color has a chrome of 2 or less.

Clay. As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—

Loose.—Noncoherent when dry or moist; does not hold together in a mass.

Friable.— When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.

Soft.—When dry, breaks into powder or individual grains under very slight pressure.

Cemented.—Hard and brittle; little affected by moistening.

Drainage class (natural). Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low available water capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have uniform color in the A and upper B horizons and mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state. In engineering, a high liquid limit indicates that the soil has a high content of clay and a low capacity for supporting loads.

Loam. Soil material that contains 7 to 27 percent clay, 28 to 30 percent silt, and less than 52 percent sand.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of drainage. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse*; and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine,* less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse,* more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Organic matter (content). Ratings in this soil survey have the following limits: very low—less than 1 percent by volume, low—1 to 2 percent, moderate—2 to 4 percent, and high—more than 4 percent.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Percolation. The downward movement of water through the soil.

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *slow, moderately slow, moderate, moderately rapid,* and *rapid.*

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from a semisolid to a plastic state.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material.

Quartzose. A term applied to material that is composed mainly of quartz but also contains other minerals.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

Runoff. Surface drainage of rain or melted snow.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Series, soil. A group of soils developed from a particular type of parent material and having genetic horizons that, except for texture of the surface layer, are similar in differentiating characteristics and in arrangement in the profile.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes the A and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and other plants and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular. Structureless* soils are either *single grained* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Topsoil. A presumed fertile soil or soil material, or one that responds to fertilization, ordinarily rich in organic matter, used to topdress roadbanks, lawns, and gardens.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water for 2 weeks or more. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, including information on use and management, read both the description of the mapping unit and the description of the soil series to which the mapping unit belongs.

Map symbol	Mapping unit	Described on page	Capability unit	Woodland suitability group	Landscape planting group
Ac	Atsion sand	11	Vw-26	3w1	3
AmB	Aura loamy sand, 0 to 5 percent slopes	12	IIIs-10	3o1	1
ArA	Aura sandy loam, 0 to 2 percent slopes	12	IIs-9	3o1	1
ArB	Aura sandy loam, 2 to 5 percent slopes	12	IIs-9	3o1	1
AvB	Aura soils, ironstone variant, 0 to 5 percent slopes	13	IVs-10	3o1	1
Bp	Berryland sand	14	Vw-26	3w1	3
BS	Berryland sand, flooded	14	Vw-26	3w1	3
Cu	Coastal beach-Urban land complex	14	VIIIs-31	---	--
DoA	Downer loamy sand, 0 to 5 percent slopes	15	IIs-6	3o1	1
DsA	Downer sandy loam, 0 to 2 percent slopes	15	I-5	3o1	1
EvB	Evesboro sand, 0 to 5 percent slopes	16	VIIs-8	4s1	4
EwB	Evesboro sand, clayey substratum, 0 to 5 percent slopes	16	IVs-8	3s1	4
FL	Fill land	16	--------	---	--
FM	Fill land over Tidal marsh	16	--------	---	--
FrA	Fort Mott sand, 0 to 5 percent slopes	18	IIIs-6	3o1	1
HaA	Hammonton loamy sand, 0 to 3 percent slopes	19	IIw-15	2o1	2
HcA	Hammonton loamy sand, clayey substratum, 0 to 2 percent slopes	19	IIw-15	2o1	2
HmA	Hammonton sandy loam, 0 to 2 percent slopes	19	IIw-15	2o1	2
HnA	Hammonton sandy loam, clayey substratum, 0 to 2 percent slopes	19	IIw-15	2o1	2
KmA	Klej loamy sand, 0 to 3 percent slopes	20	IIIw-16	3s1	2
KnA	Klej loamy sand, clayey substratum, 0 to 3 percent slopes	20	IIIw-16	3s1	2
LaA	Lakehurst sand, 0 to 3 percent slopes	21	IVw-17	4s1	2
LeB	Lakewood sand, 0 to 5 percent slopes	22	VIIs-8	5s1	4
LeC	Lakewood sand, 5 to 10 percent slopes	22	VIIs-8	5s1	4
MtA	Matawan sandy loam, 0 to 5 percent slopes	23	IIe-2	2o1	2
MU	Muck	23	VIIw-30	3w2	--
Po	Pocomoke sandy loam	24	IIIw-25	2w1	3
SaA	Sassafras sandy loam, 0 to 2 percent slopes	26	I-5	3o1	1
SaB	Sassafras sandy loam, 2 to 5 percent slopes	26	IIe-5	3o1	1
TD	Tidal marsh, deep	27	VIIIw-29	---	--
TM	Tidal marsh, moderately deep	27	VIIIw-29	---	--
TS	Tidal marsh, shallow	27	VIIIw-29	---	--
WcA	Woodstown sandy loam, 0 to 2 percent slopes	28	IIw-14	2o1	2

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NEW JERSEY DEPARTMENT OF AGRICULTURE

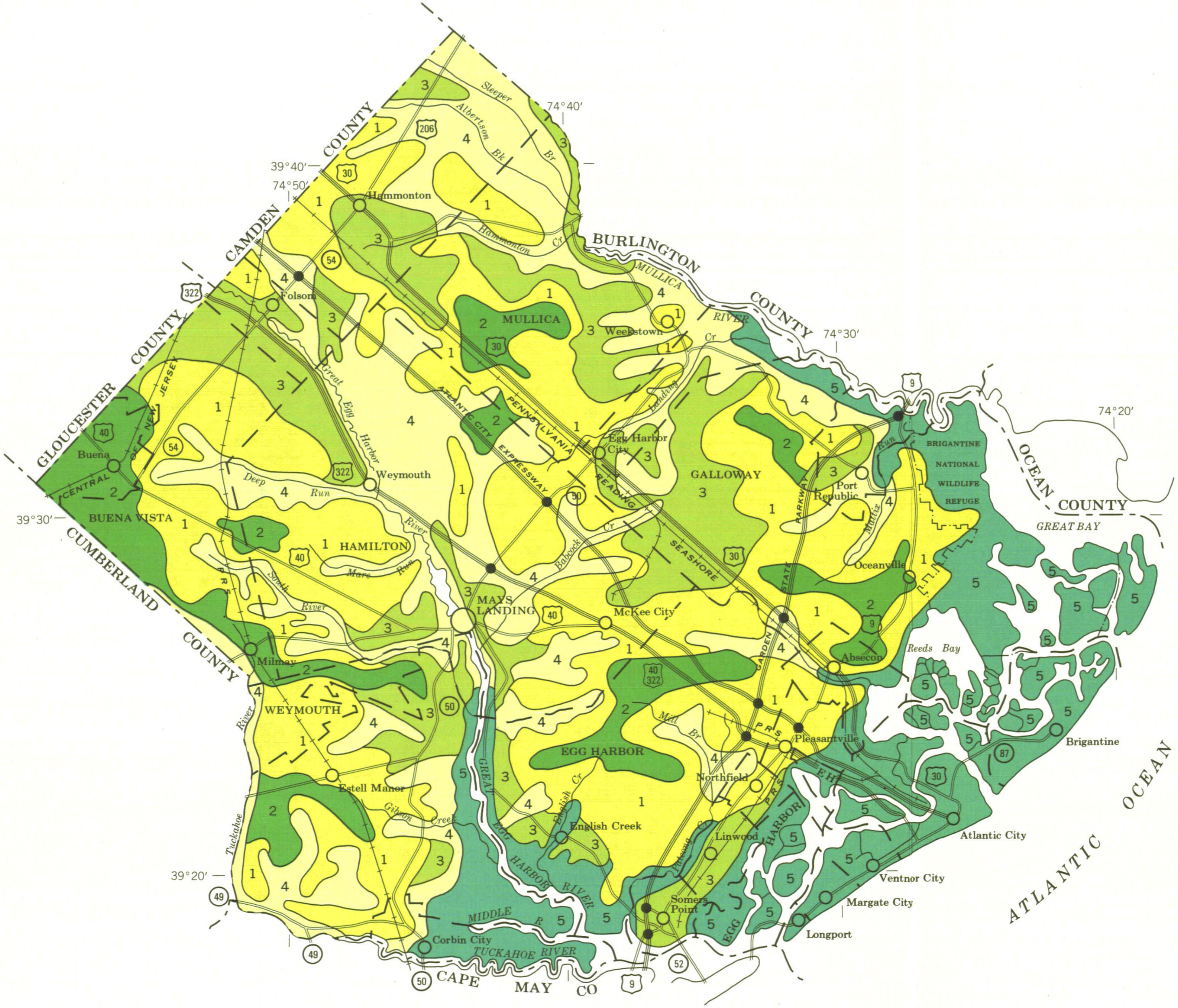
GENERAL SOIL MAP

ATLANTIC COUNTY, NEW JERSEY

Scale 1:253,440

1 0 1 2 3 4 Miles

N

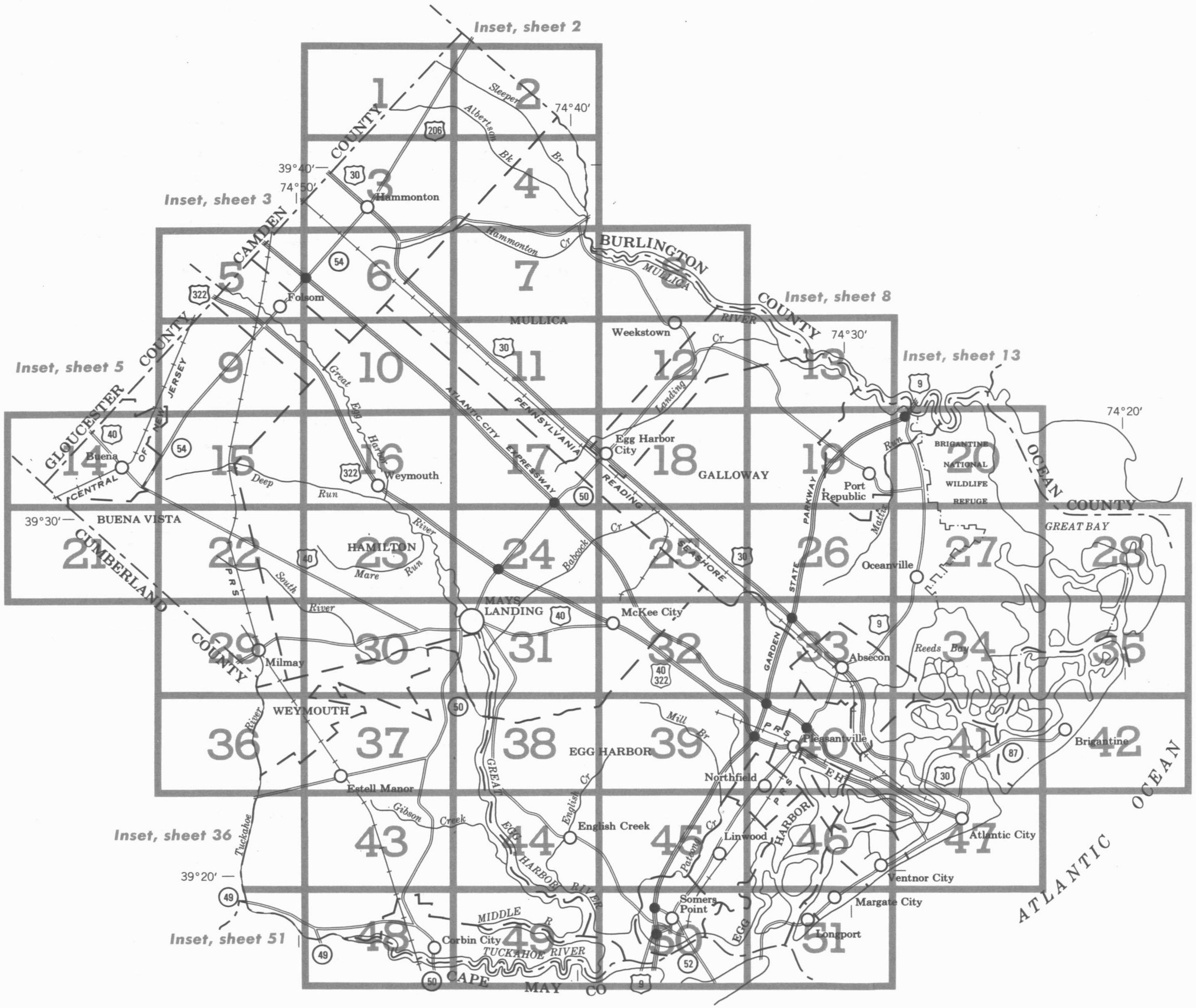


SOIL ASSOCIATIONS

1. Downer-Hammonton-Sassafras association: Nearly level or gently sloping, well drained to somewhat poorly drained soils that have a loamy subsoil
2. Sassafras-Aura-Woodstown association: Nearly level or gently sloping, well drained and moderately well drained soils that have a loamy subsoil
3. Klej-Lakehurst-Evesboro association: Nearly level to gently sloping, excessively drained to somewhat poorly drained soils that have a sandy subsoil
4. Atsion-Muck-Pocomoke association: Nearly level, poorly drained and very poorly drained soils that have a sandy or loamy subsoil, and organic soils underlain mainly by sand
5. Tidal marsh-Fill land-Coastal beach association: Nearly level, poorly drained tidal flats; nearly level, excessively drained sandy Fill land; and nearly level or gently sloping, excessively drained coastal beaches

Compiled 1976

Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.



INDEX TO MAP SHEETS
ATLANTIC COUNTY, NEW JERSEY

Scale 1:253,440

1 0 1 2 3 4 Miles

SOIL LEGEND

The first letter, always a capital, is the initial letter of the soil name. The second letter is a capital letter if the unit is broadly defined; otherwise it is a small letter. The third letter, A, B, or C, indicates the slope. Most symbols without a slope letter are for nearly level soils, but some are for miscellaneous land types.

SYMBOL	NAME
Ac	Atsion sand
AmB	Aura loamy sand, 0 to 5 percent slopes
ArA	Aura sandy loam, 0 to 2 percent slopes
ArB	Aura sandy loam, 2 to 5 percent slopes
AvB	Aura soils, ironstone variant, 0 to 5 percent slopes
Bp	Berryland sand
BS	Berryland sand, flooded *
Cu	Coastal beach-Urban land complex
DoA	Downer loamy sand, 0 to 5 percent slopes
DsA	Downer sandy loam, 0 to 2 percent slopes
EvB	Evesboro sand, 0 to 5 percent slopes
EwB	Evesboro sand, clayey substratum, 0 to 5 percent slopes
FL	Fill land *
FM	Fill land, over Tidal Marsh *
FrA	Fort Mott sand, 0 to 5 percent slopes
HaA	Hammonton loamy sand, 0 to 3 percent slopes
HcA	Hammonton loamy sand, clayey substratum, 0 to 2 percent slopes
HmA	Hammonton sandy loam, 0 to 2 percent slopes
HnA	Hammonton sandy loam, clayey substratum, 0 to 2 percent slopes
KmA	Klej loamy sand, 0 to 3 percent slopes
KnA	Klej loamy sand, clayey substratum, 0 to 3 percent slopes
LaA	Lakehurst sand, 0 to 3 percent slopes
LeB	Lakewood sand, 0 to 5 percent slopes
LeC	Lakewood sand, 5 to 10 percent slopes
MtA	Matawan sandy loam, 0 to 5 percent slopes
MU	Muck *
Po	Pocomoke sandy loam
SaA	Sassafras sandy loam, 0 to 2 percent slopes
SaB	Sassafras sandy loam, 2 to 5 percent slopes
TD	Tidal marsh, deep *
TM	Tidal marsh, moderately deep *
TS	Tidal marsh, shallow *
WcA	Woodstown sandy loam, 0 to 2 percent slopes

* The composition of these units is more variable than that of other units in the survey area but has been controlled well enough for interpretations to be made for the expected uses of the soils.

CONVENTIONAL SIGNS

WORKS AND STRUCTURES

Highways and roads
- Divided
- Good motor
- Poor motor
- Trail

Highway markers
- National Interstate
- U. S.
- State or county

Railroads
- Single track
- Multiple track
- Abandoned

Bridges and crossings
- Road
- Trail
- Railroad
- Ferry (FY)
- Ford (FORD)
- Grade
- R. R. over
- R. R. under

Buildings
- School
- Church

Mine and quarry

Gravel pit

Power line

Pipeline

Cemetery

Dams

Levee

Tanks

Well, oil or gas

Forest fire or lookout station

Windmill

Located object

BOUNDARIES

- National or state
- County
- Minor civil division
- Reservation
- Land grant
- Small park, cemetery, airport
- Land survey division corners

DRAINAGE

Streams, double-line
- Perennial
- Intermittent

Streams, single-line
- Perennial
- Intermittent
  - Crossable with tillage implements
  - Not crossable with tillage implements
  - Unclassified

Canals and ditches

Lakes and ponds
- Perennial (water, w)
- Intermittent (int)

Spring

Marsh or swamp

Wet spot

Drainage end or alluvial fan

RELIEF

Escarpments
- Bedrock
- Other

Short steep slope

Prominent peak

Depressions (Large, Small)
- Crossable with tillage implements
- Not crossable with tillage implements
- Contains water most of the time

SOIL SURVEY DATA

- Soil boundary and symbol (Dx)
- Gravel
- Stoniness
  - Stony
  - Very stony
- Rock outcrops
- Chert fragments
- Clay spot
- Sand spot
- Gumbo or scabby spot
- Made land (M.L.)
- Severely eroded spot
- Blowout, wind erosion
- Gully
- Borrow pit (B.P.)

1

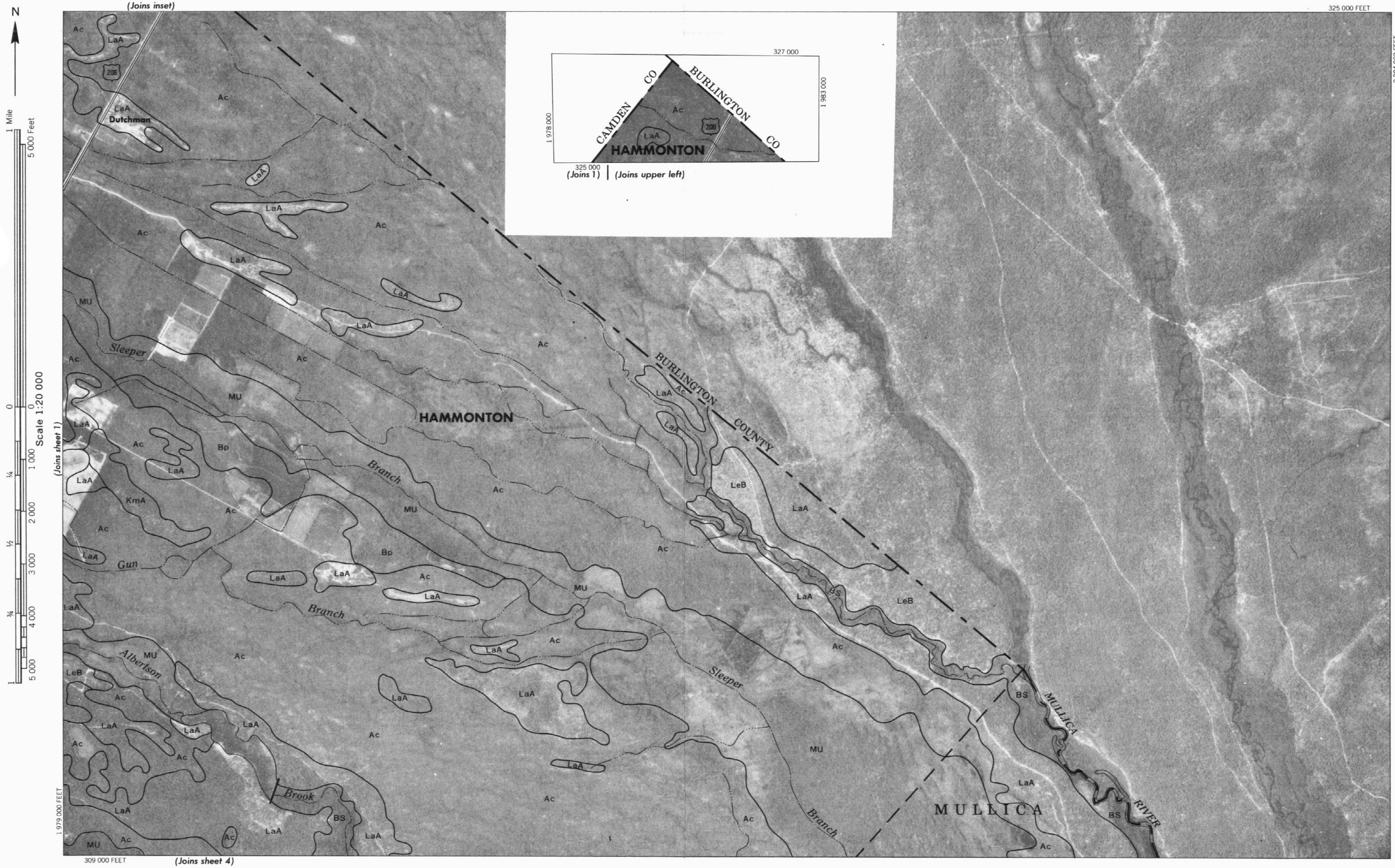
N

Scale 1:20 000

1 Mile
0 ¼ ½ ¾ 1
5 000 Feet
0 1 000 2 000 3 000 4 000 5 000

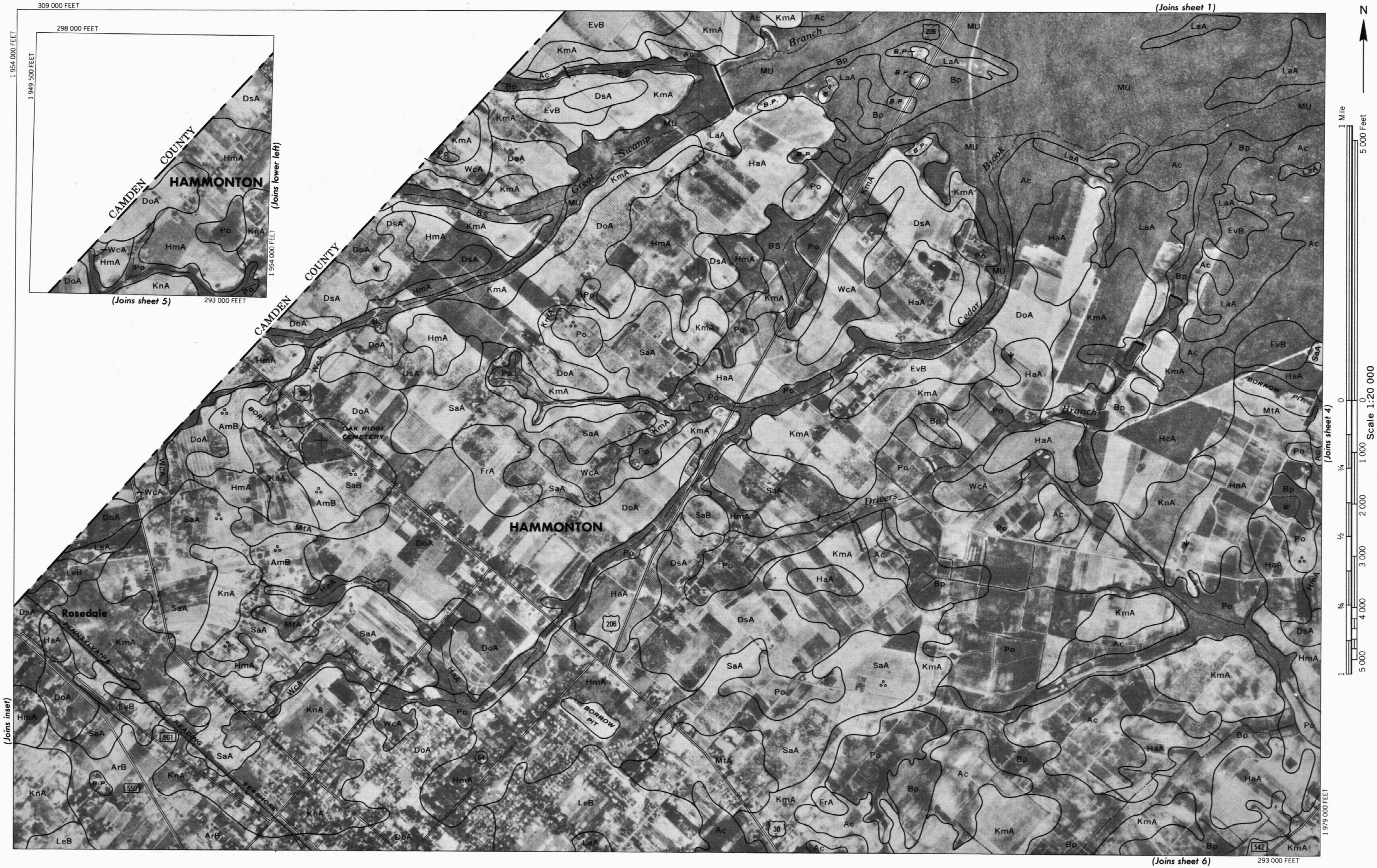
ATLANTIC COUNTY, NEW JERSEY NO. 1

This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.



This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.

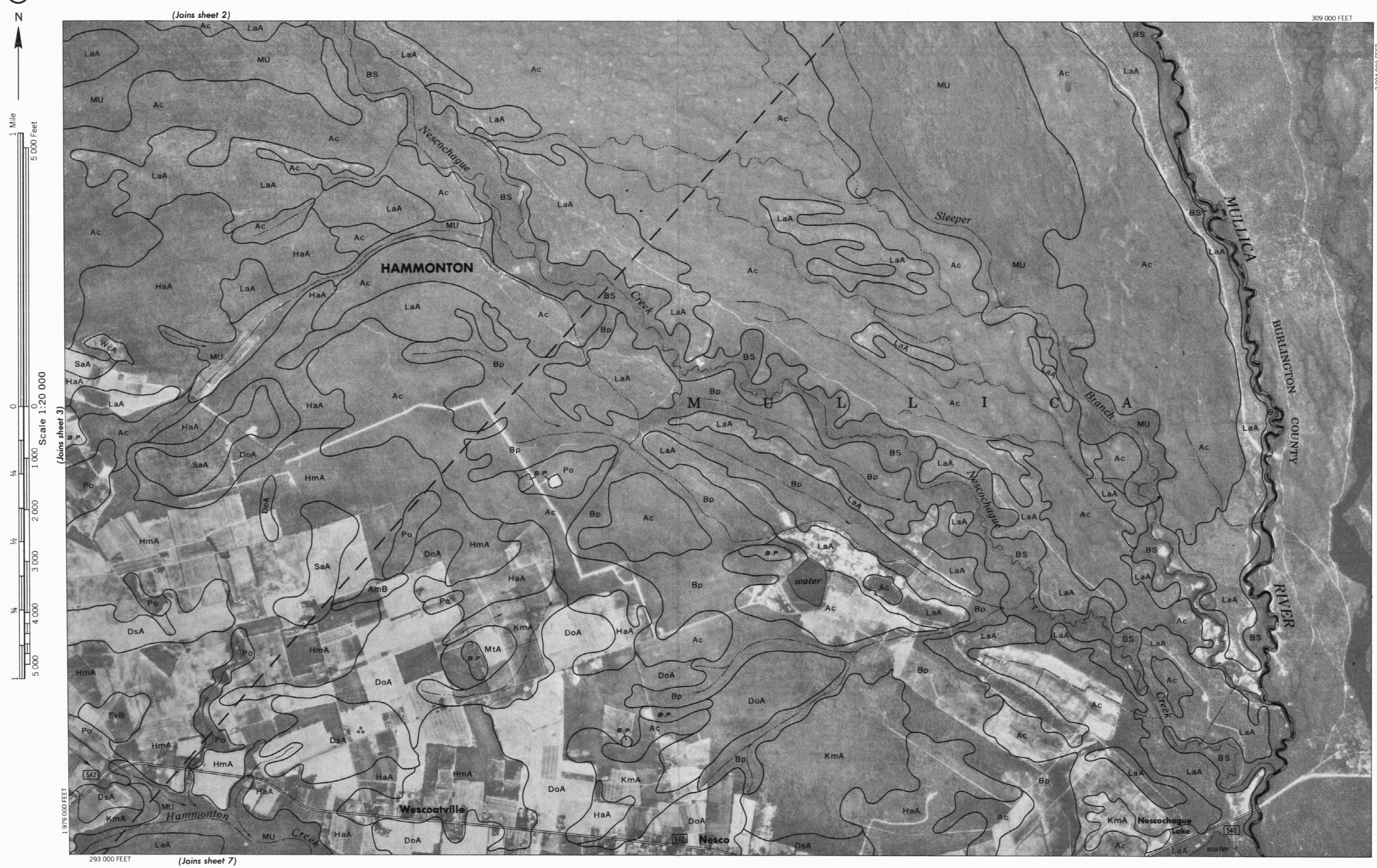
3



ATLANTIC COUNTY, NEW JERSEY NO. 3

This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.

ATLANTIC COUNTY, NEW JERSEY — SHEET NUMBER 4



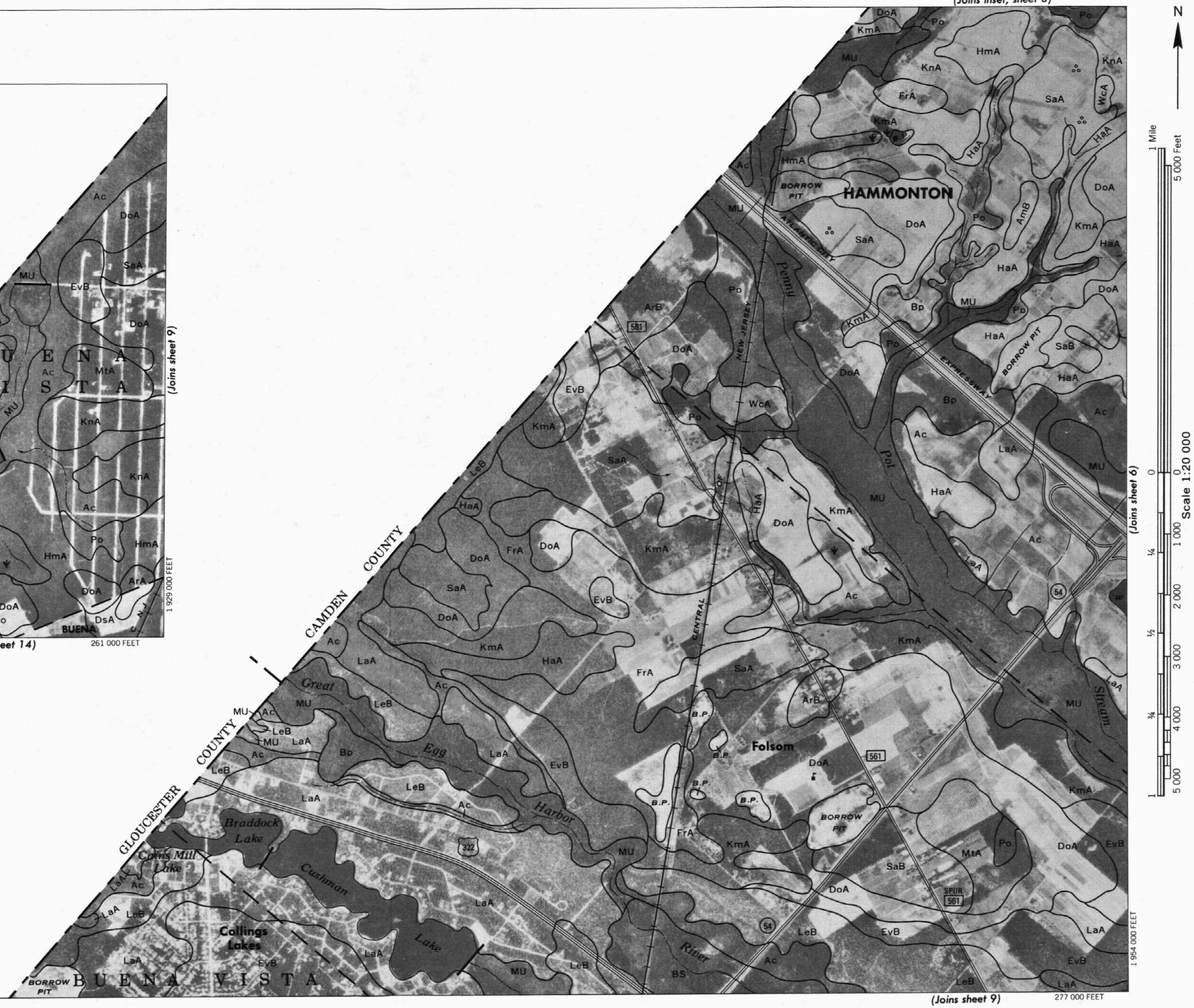
This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.

ATLANTIC COUNTY, NEW JERSEY NO. 4

5

ATLANTIC COUNTY, NEW JERSEY NO. 5

This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.



N

(Joins sheet 3)

(Joins sheet 5)

(Joins sheet 7)

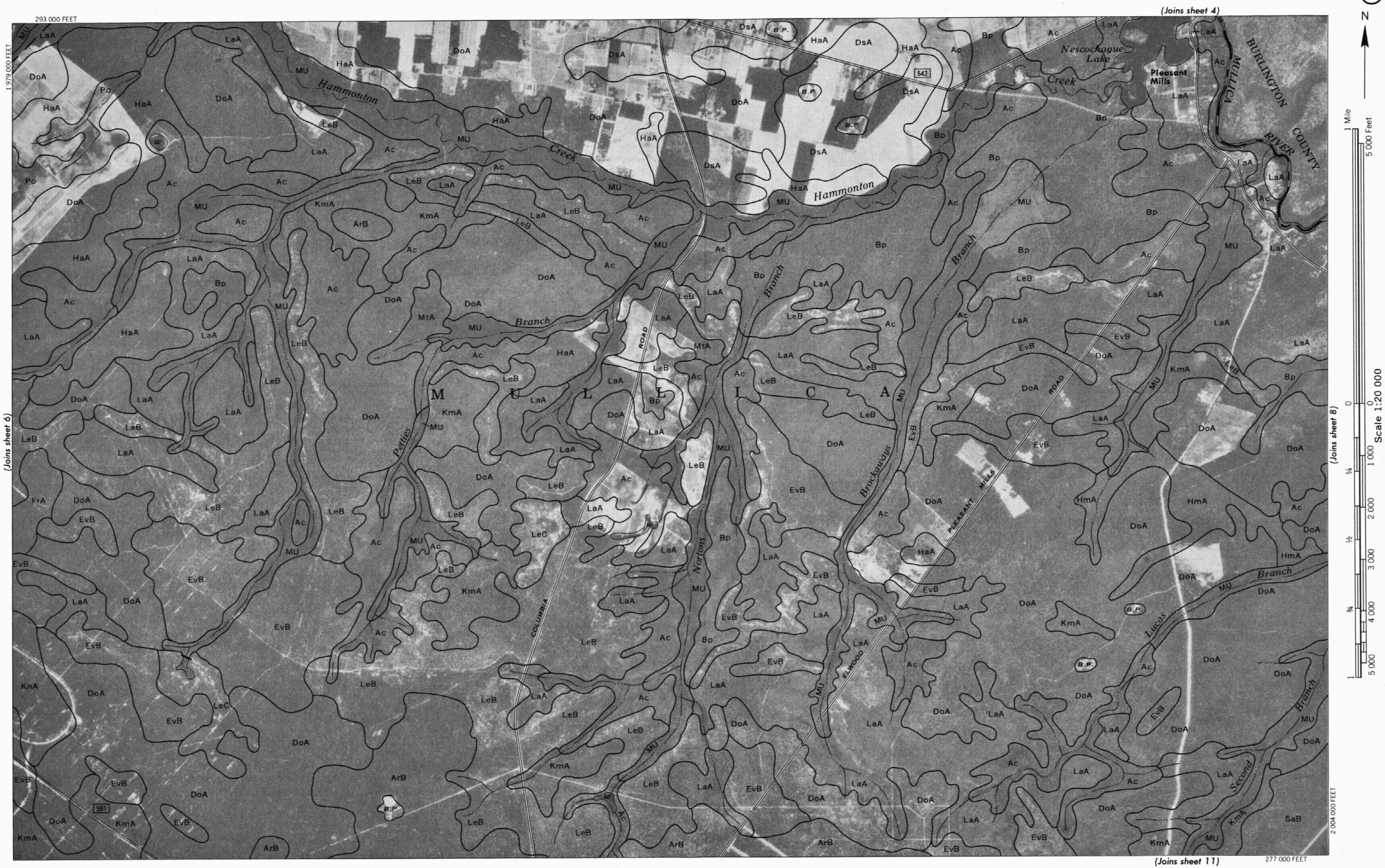
(Joins sheet 10)

Scale 1:20 000

1 Mile | ¾ | ½ | ¼ | 0

5 000 Feet | 4 000 | 3 000 | 2 000 | 1 000 | 0

This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Positions of grid lines are approximate and based on the New Jersey coordinate system.



ATLANTIC COUNTY, NEW JERSEY NO. 7

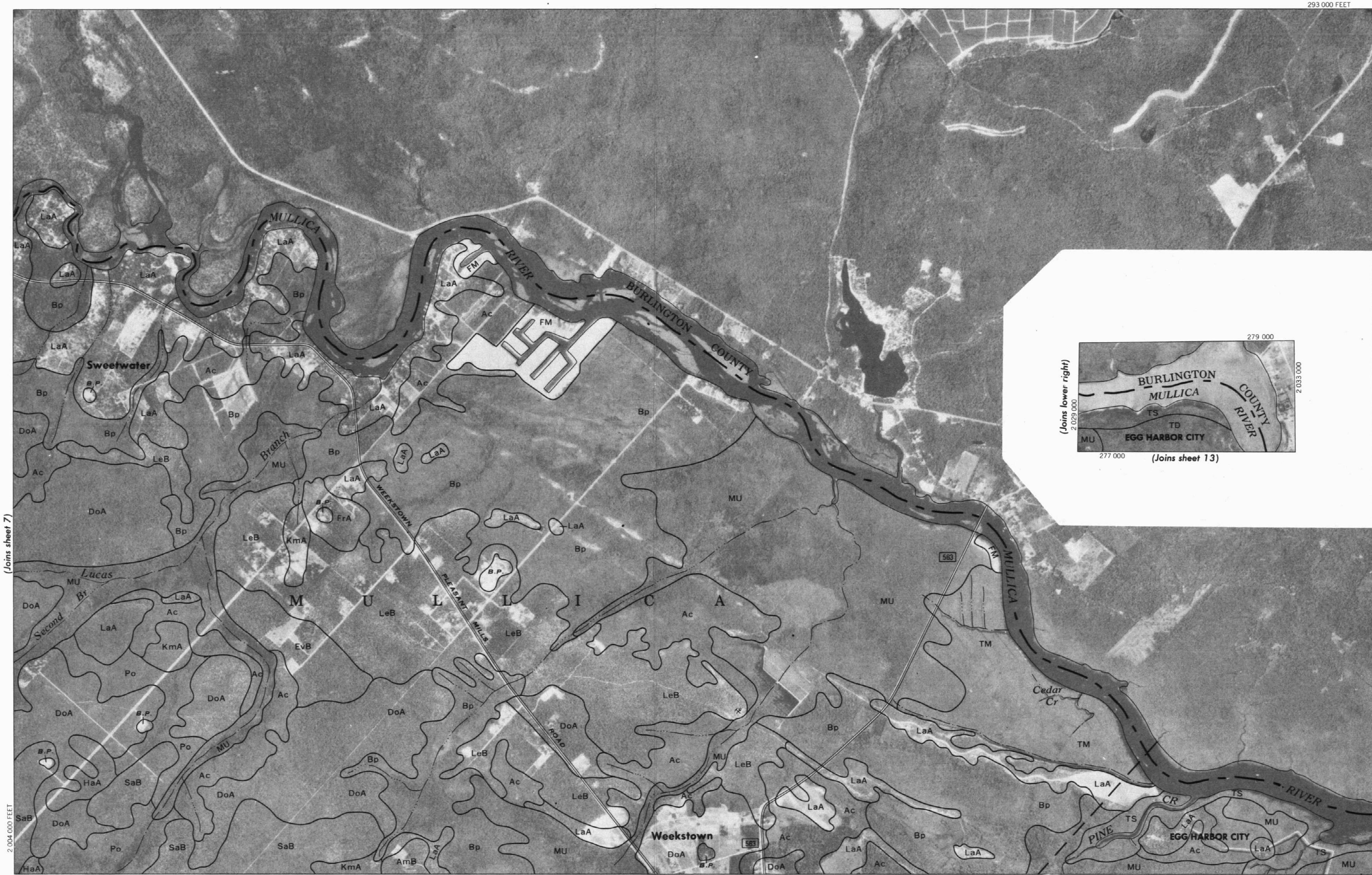
This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.

8

N

Scale 1:20 000

1 Mile
5 000 Feet



This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.

9

277 000 FEET

(Joins sheet 5)

1 929 000 FEET

(Joins inset, sheet 5)

(Joins sheet 10)

(Joins sheet 15)

1 954 000 FEET

261 000 FEET

N

1 Mile

5 000 Feet

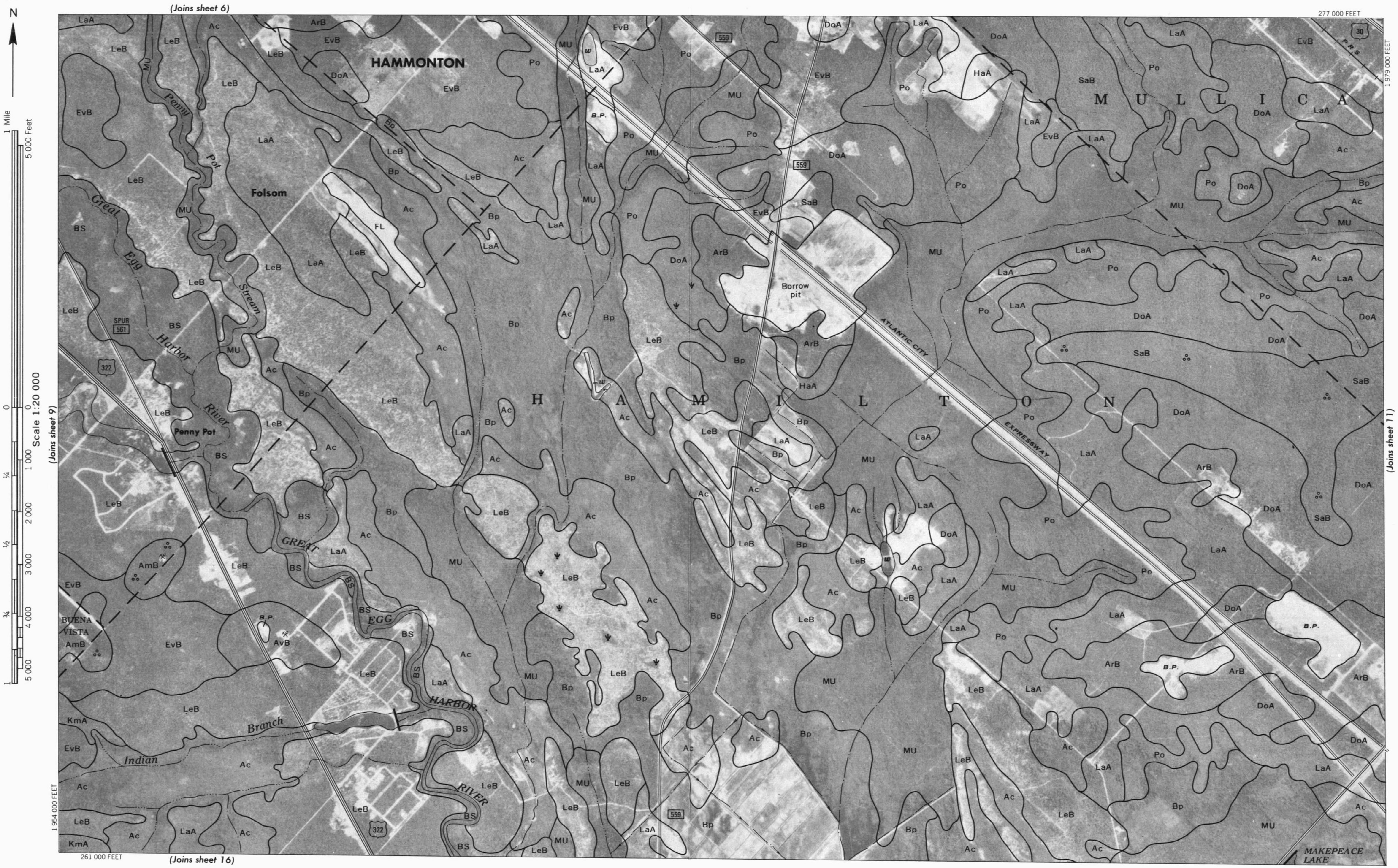
Scale 1:20 000

0 ¼ ½ ¾ 1

0 1 000 2 000 3 000 4 000 5 000

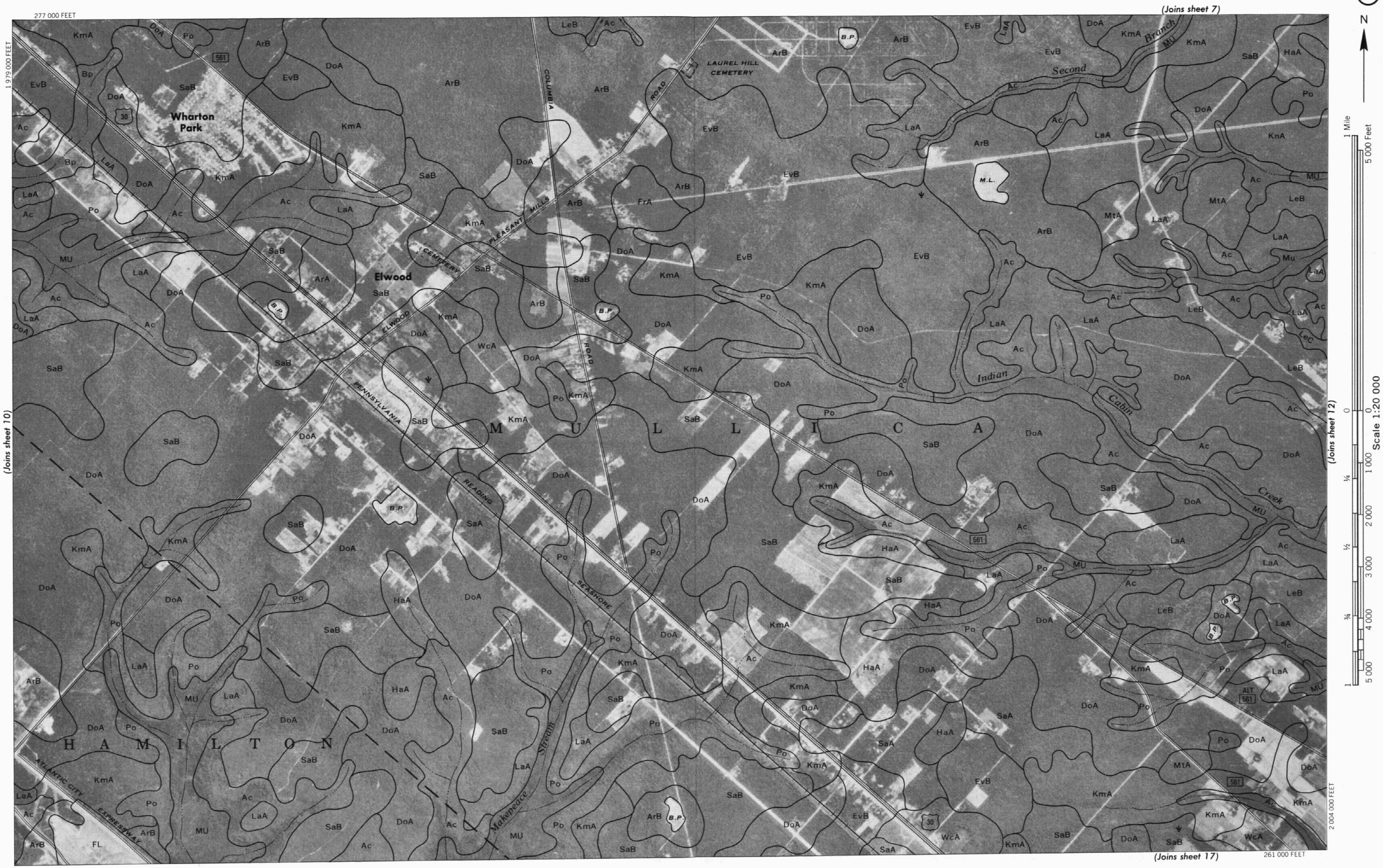
ATLANTIC COUNTY, NEW JERSEY NO. 9

This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Positions of grid lines are approximate and based on the New Jersey coordinate system.



This map is compiled on 1968 aerial photography by the U. S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.

ATLANTIC COUNTY, NEW JERSEY NO. 10



ATLANTIC COUNTY, NEW JERSEY NO. 11

This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Positions of grid lines are approximate and based on the New Jersey coordinate system.

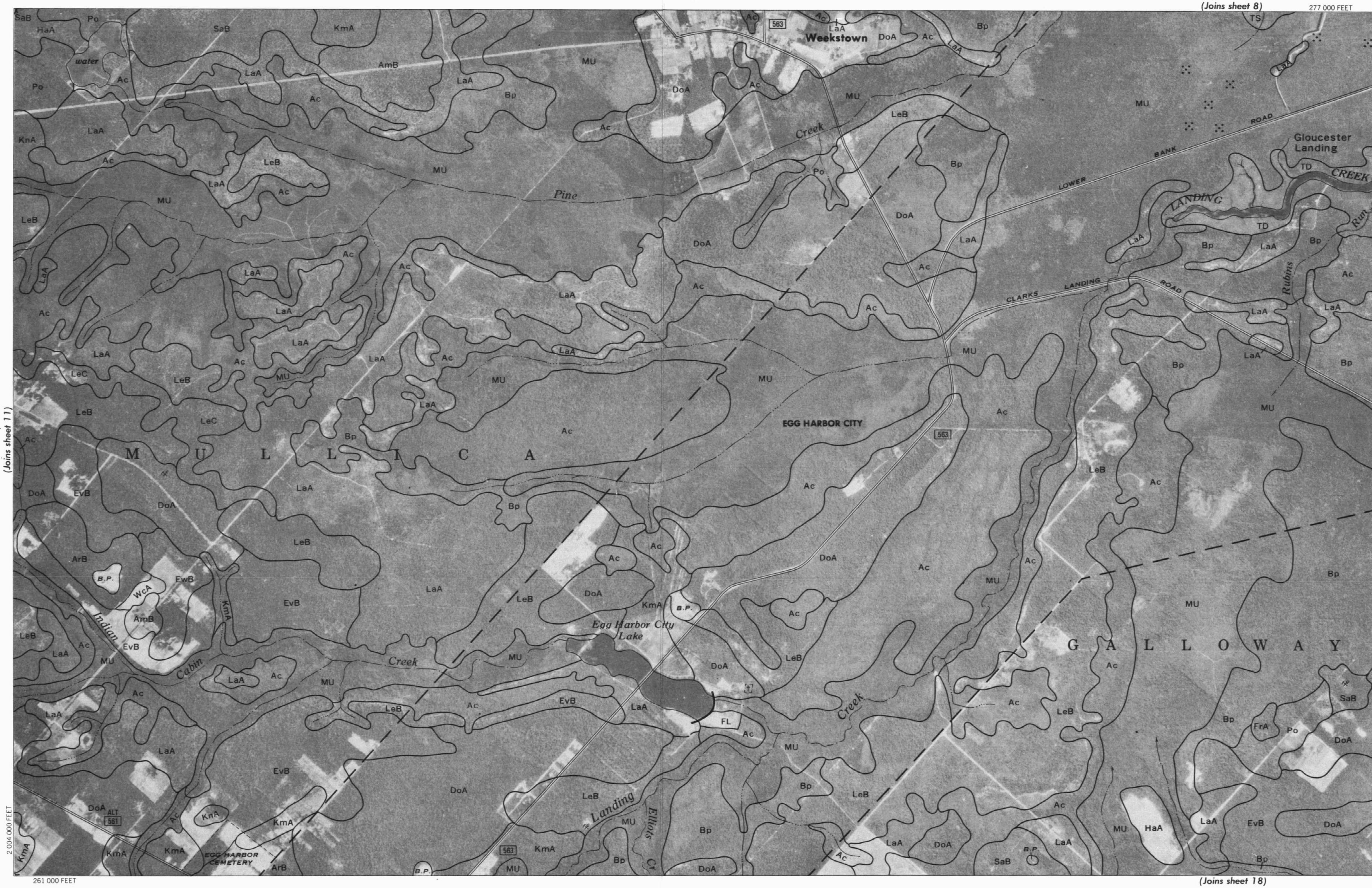
ATLANTIC COUNTY, NEW JERSEY — SHEET NUMBER 12

N

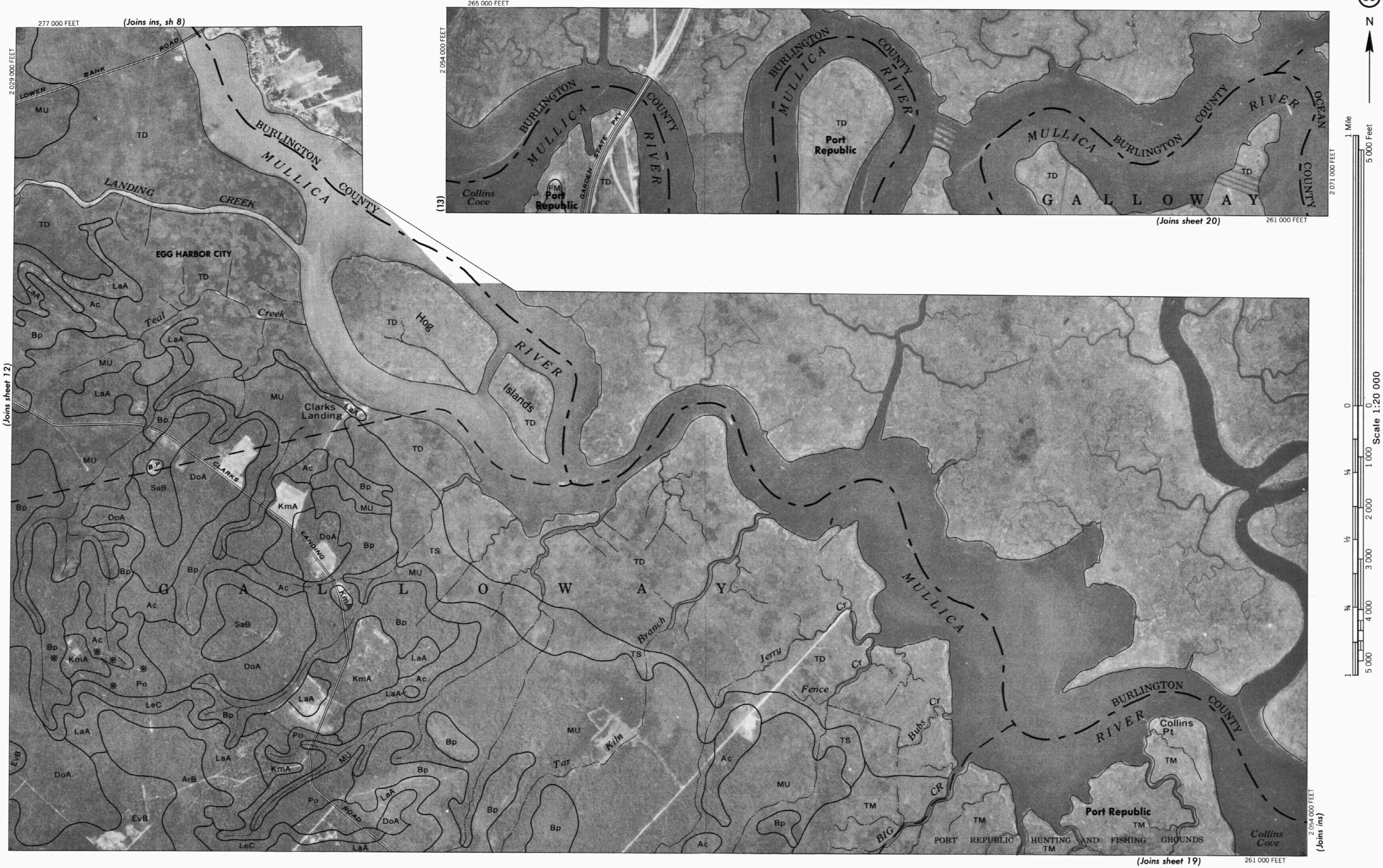
1 Mile

5 000 Feet

Scale 1:20 000



This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.



ATLANTIC COUNTY, NEW JERSEY NO. 13

This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Positions of grid lines are approximate and based on the New Jersey coordinate system.

This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.

15

(Joins sheet 9)

(Joins sheet 14)

(Joins sheet 16)

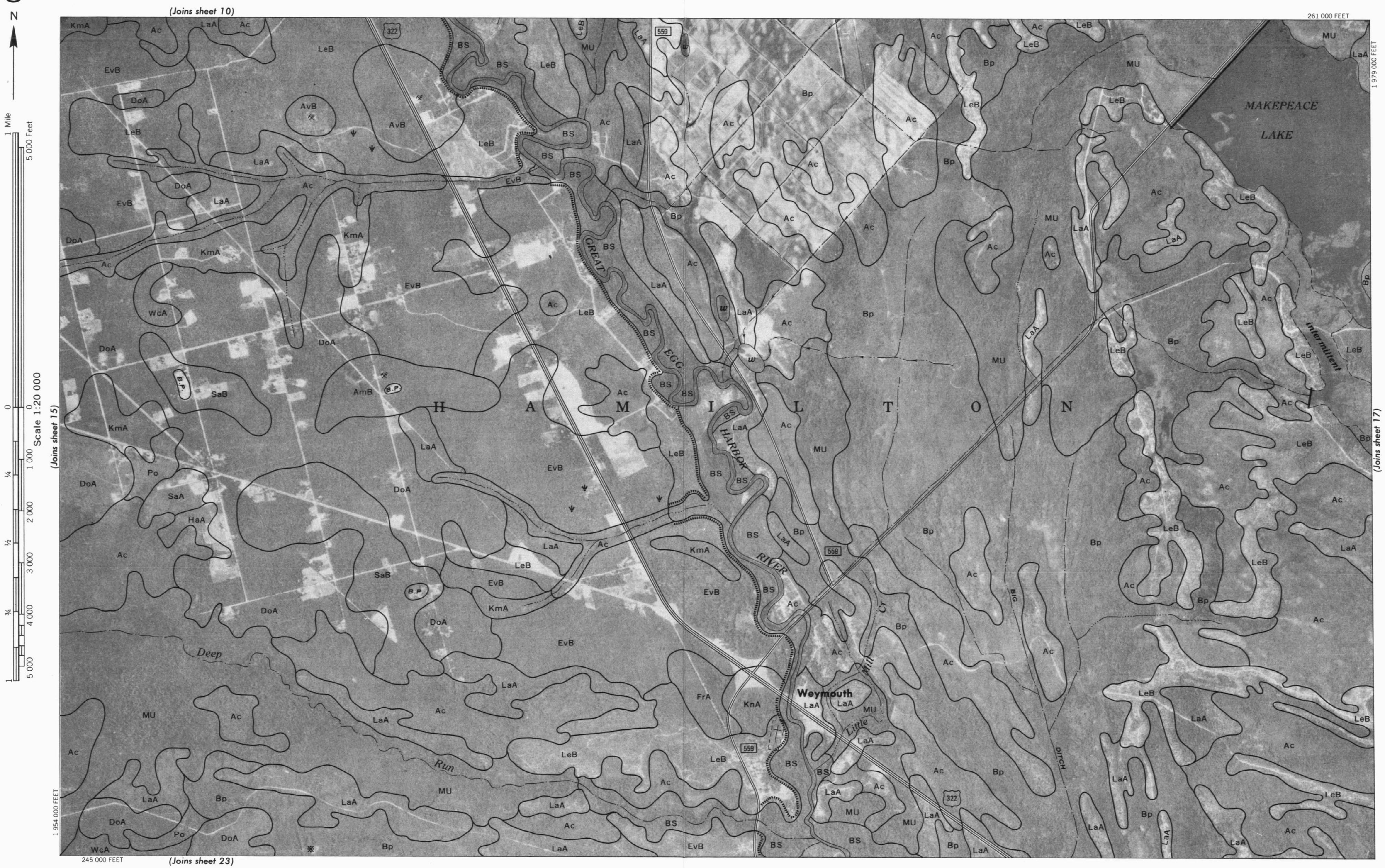
(Joins sheet 22)

N

1 Mile
5 000 Feet
Scale 1:20 000

ATLANTIC COUNTY, NEW JERSEY NO. 15

This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.



This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.

261 000 FEET

(Joins sheet 11)

1 979 000 FEET

(Joins sheet 16)

(Joins sheet 18)

N

1 Mile
¾
½
¼
0

5 000 Feet
4 000
3 000
2 000
1 000
0

Scale 1:20 000

2 004 000 FEET

(Joins sheet 24)

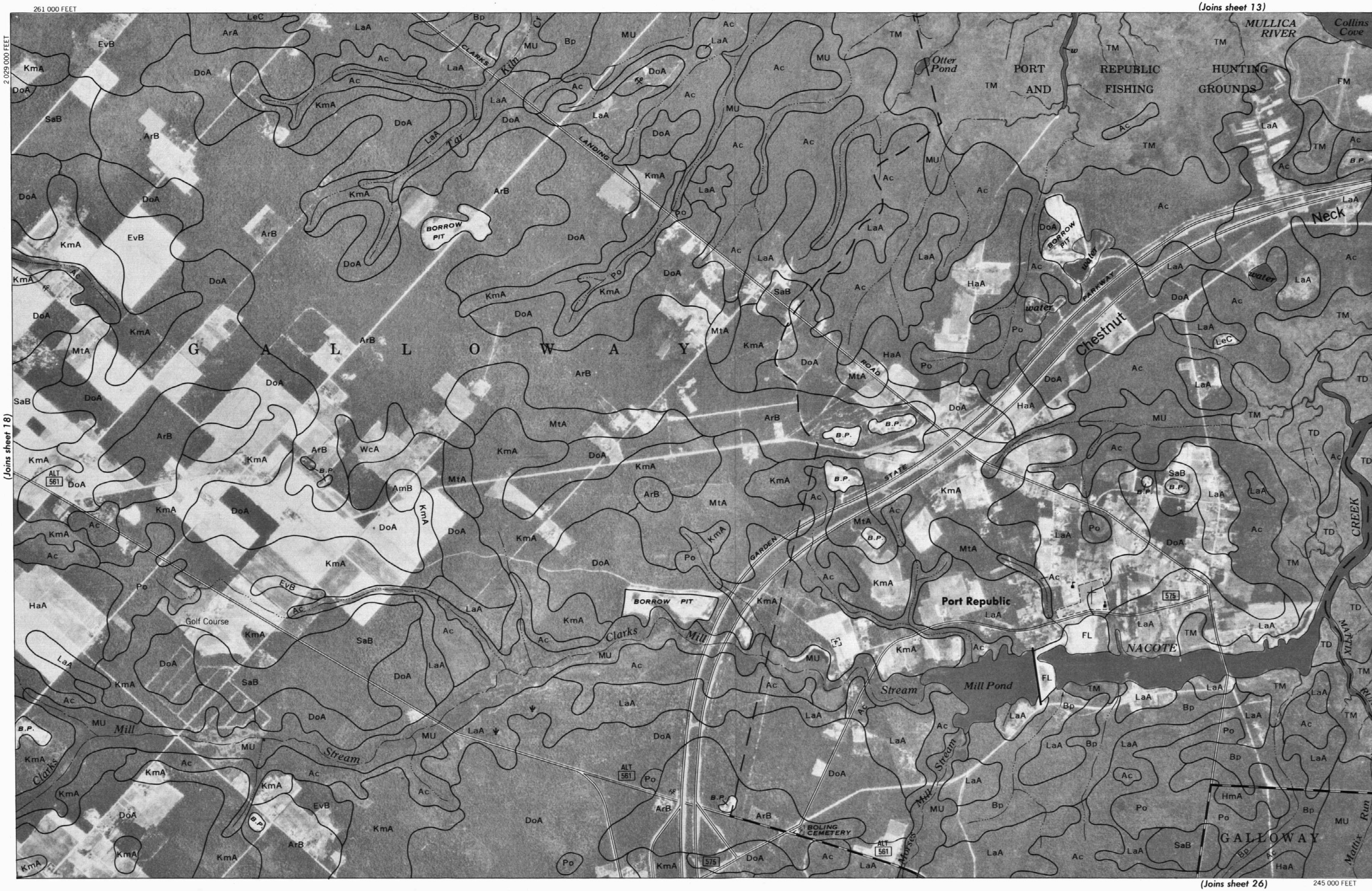
245 000 FEET

ATLANTIC COUNTY, NEW JERSEY NO. 17

This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.

This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.

19



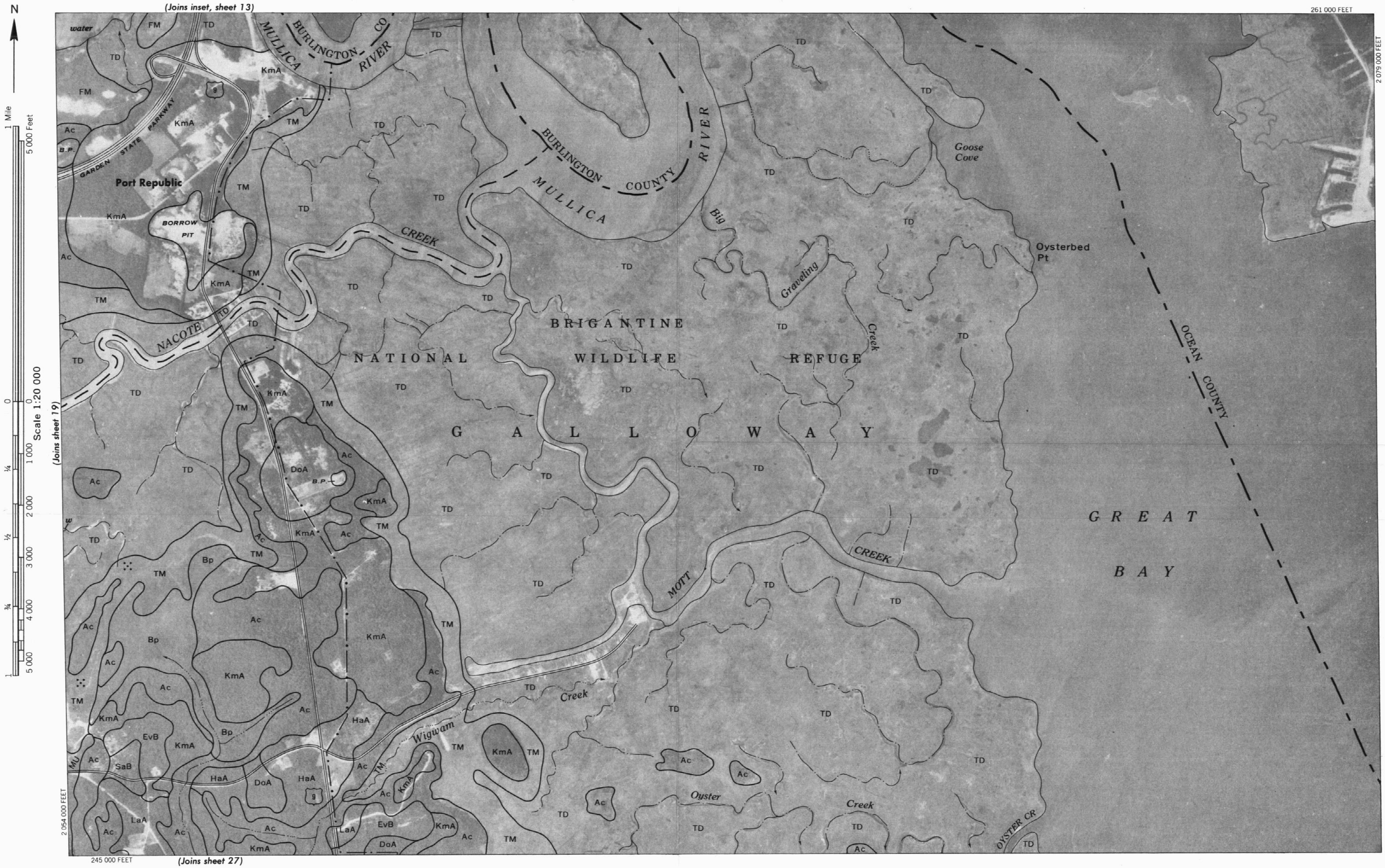
N

Scale 1:20 000

1 Mile
5 000 Feet
0 1 000 2 000 3 000 4 000 5 000

ATLANTIC COUNTY, NEW JERSEY NO. 19

This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.



This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.

ATLANTIC COUNTY, NEW JERSEY NO. 21
This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.

N

1 Mile
5 000 Feet
Scale 1:20 000

(Joins sheet 15)

(Joins sheet 21)

(Joins sheet 23)

(Joins sheet 29)

This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Positions of grid lines are approximate and based on the New Jersey coordinate system.

ATLANTIC COUNTY, NEW JERSEY NO. 23

This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.

245 000 FEET

1 954 000 FEET

(Joins sheet 16)

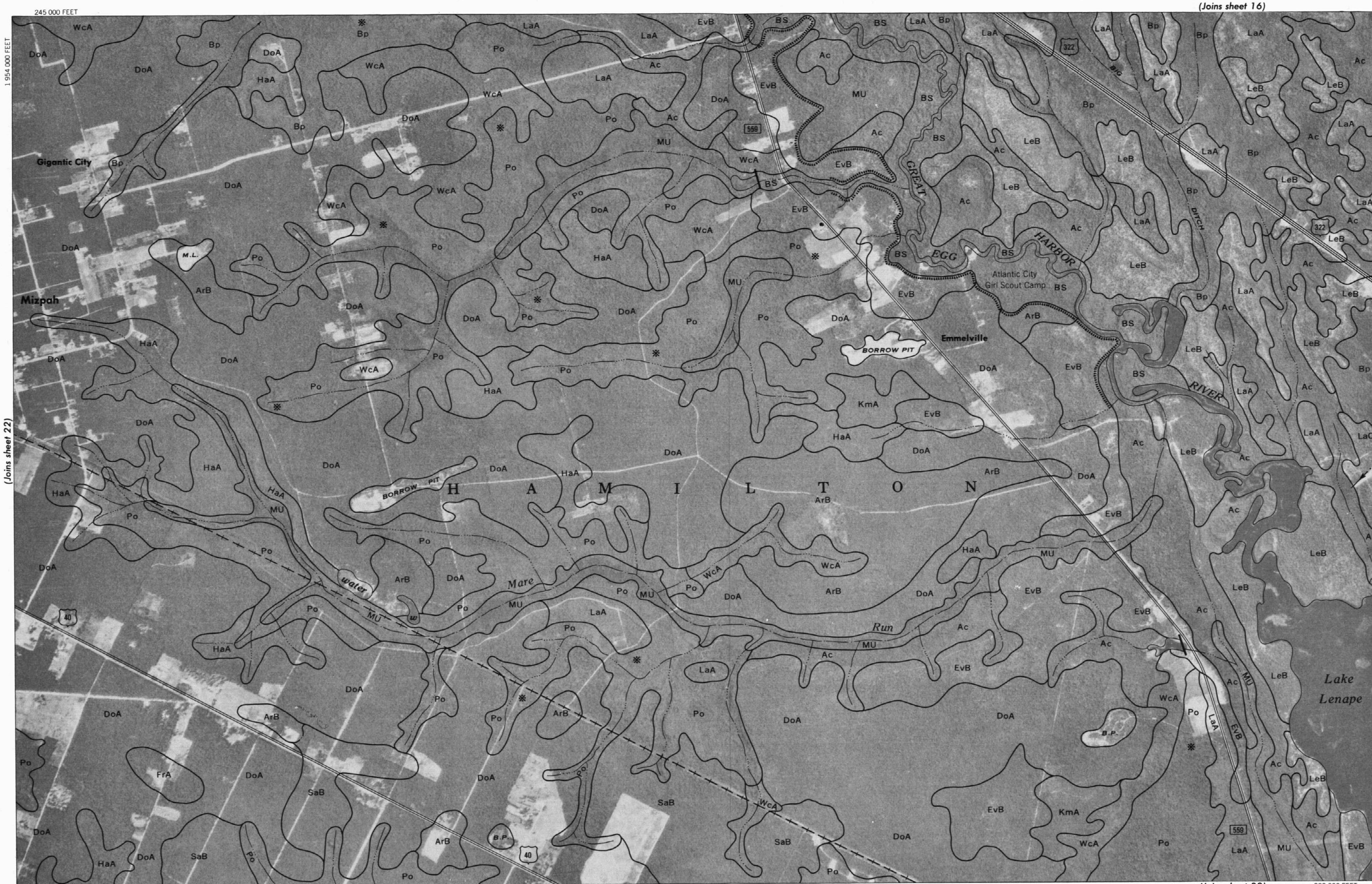
(Joins sheet 22)

(Joins sheet 24)

(Joins sheet 30)

1 979 000 FEET

229 000 FEET



N

Scale 1:20 000

1 Mile

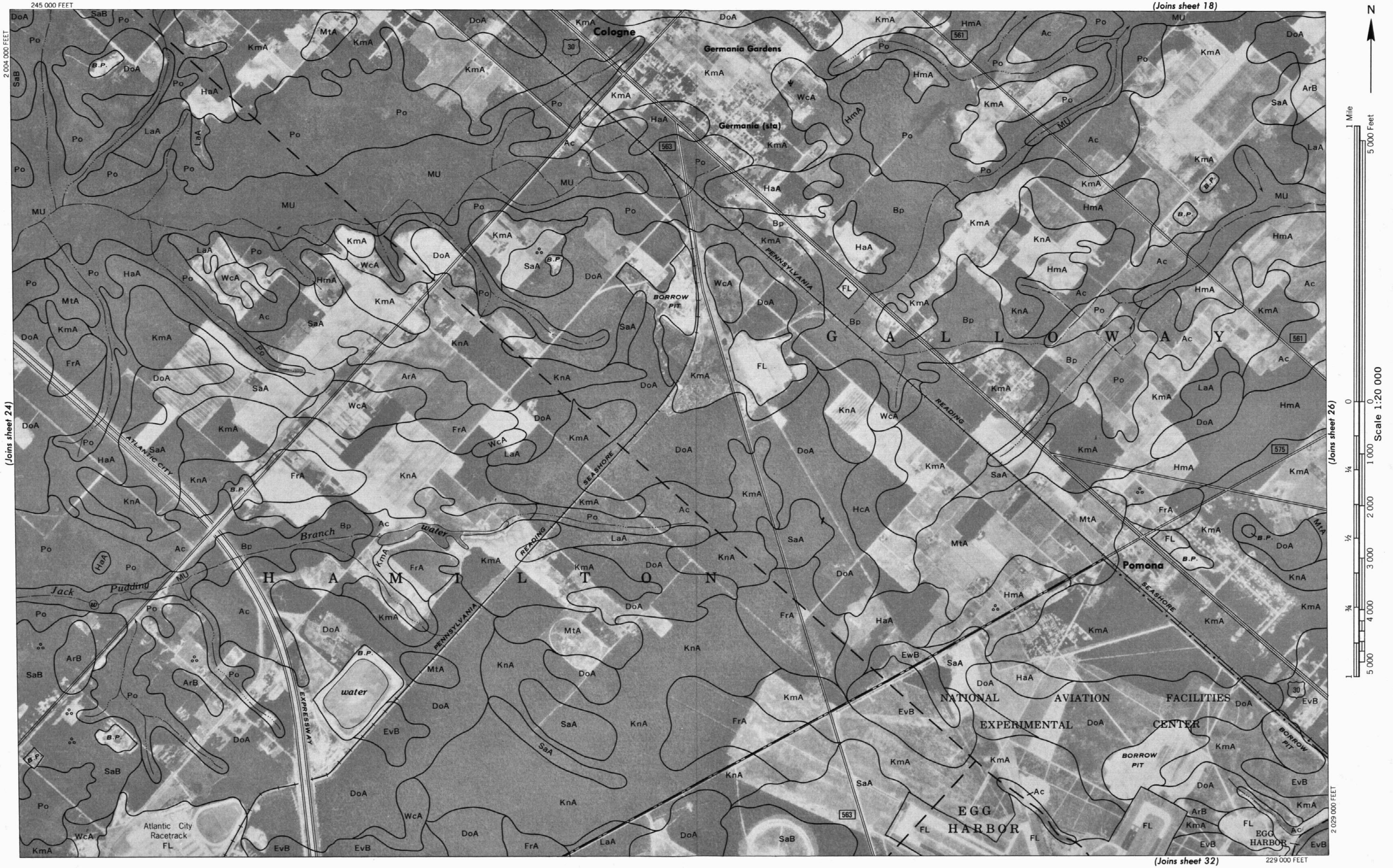
5 000 Feet

0 ¼ ½ ¾

0 1 000 2 000 3 000 4 000 5 000

This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Positions of grid lines are approximate and based on the New Jersey coordinate system.

ATLANTIC COUNTY, NEW JERSEY NO. 24



ATLANTIC COUNTY, NEW JERSEY NO. 25

This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Positions of grid lines are approximate and based on the New Jersey coordinate system.

(Joins sheet 19)

245 000 FEET

2 054 000 FEET

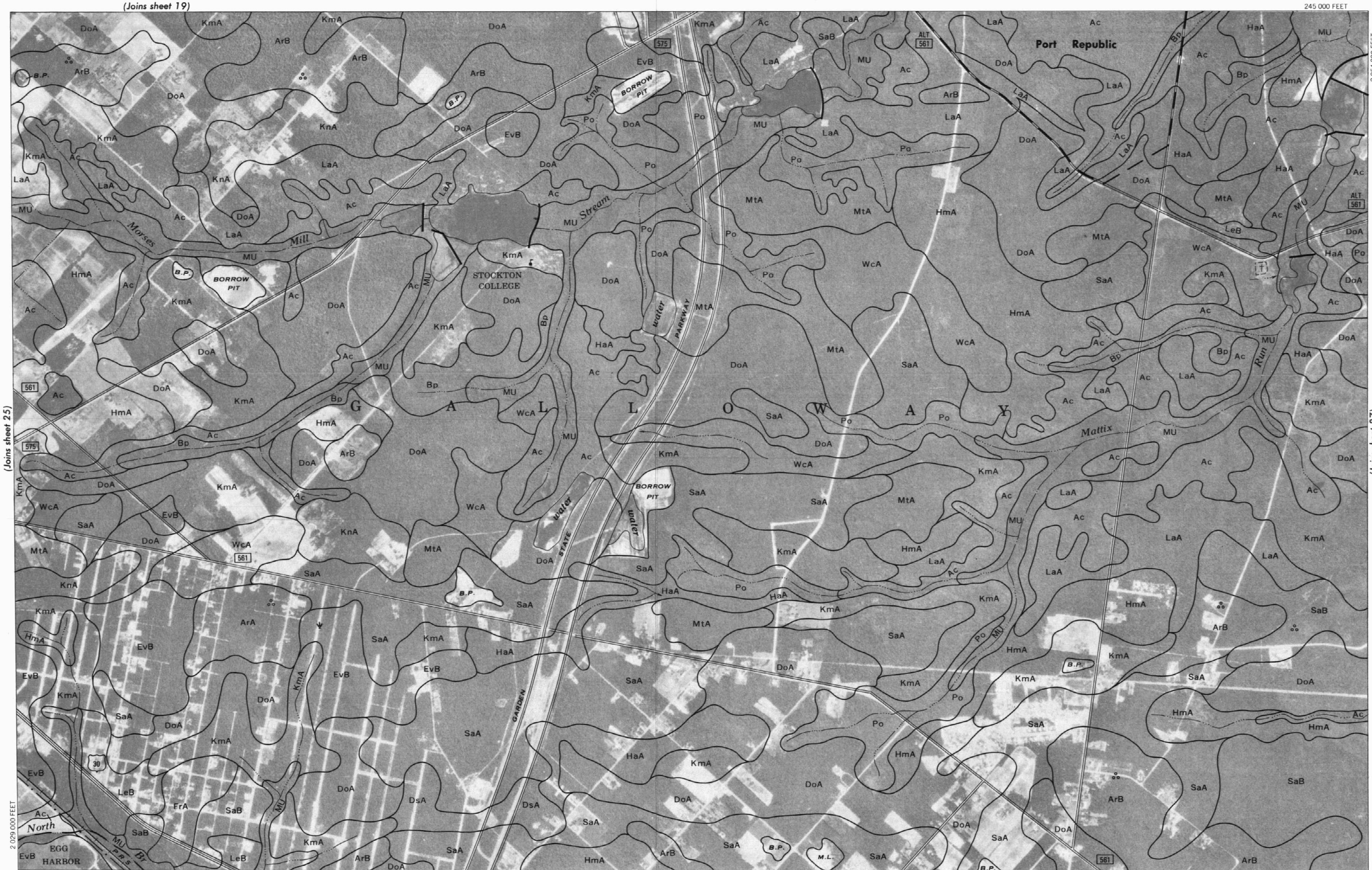
N

Scale 1:20 000

1 Mile | ¾ | ½ | ¼ | 0

5 000 Feet | 4 000 | 3 000 | 2 000 | 1 000 | 0

(Joins sheet 25)



(Joins sheet 27)

2 029 000 FEET

229 000 FEET

(Joins sheet 33)

This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.

ATLANTIC COUNTY, NEW JERSEY NO. 27

This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.

ATLANTIC COUNTY, NEW JERSEY — SHEET NUMBER 28

N

1 Mile — 5 000 Feet

Scale 1:20 000

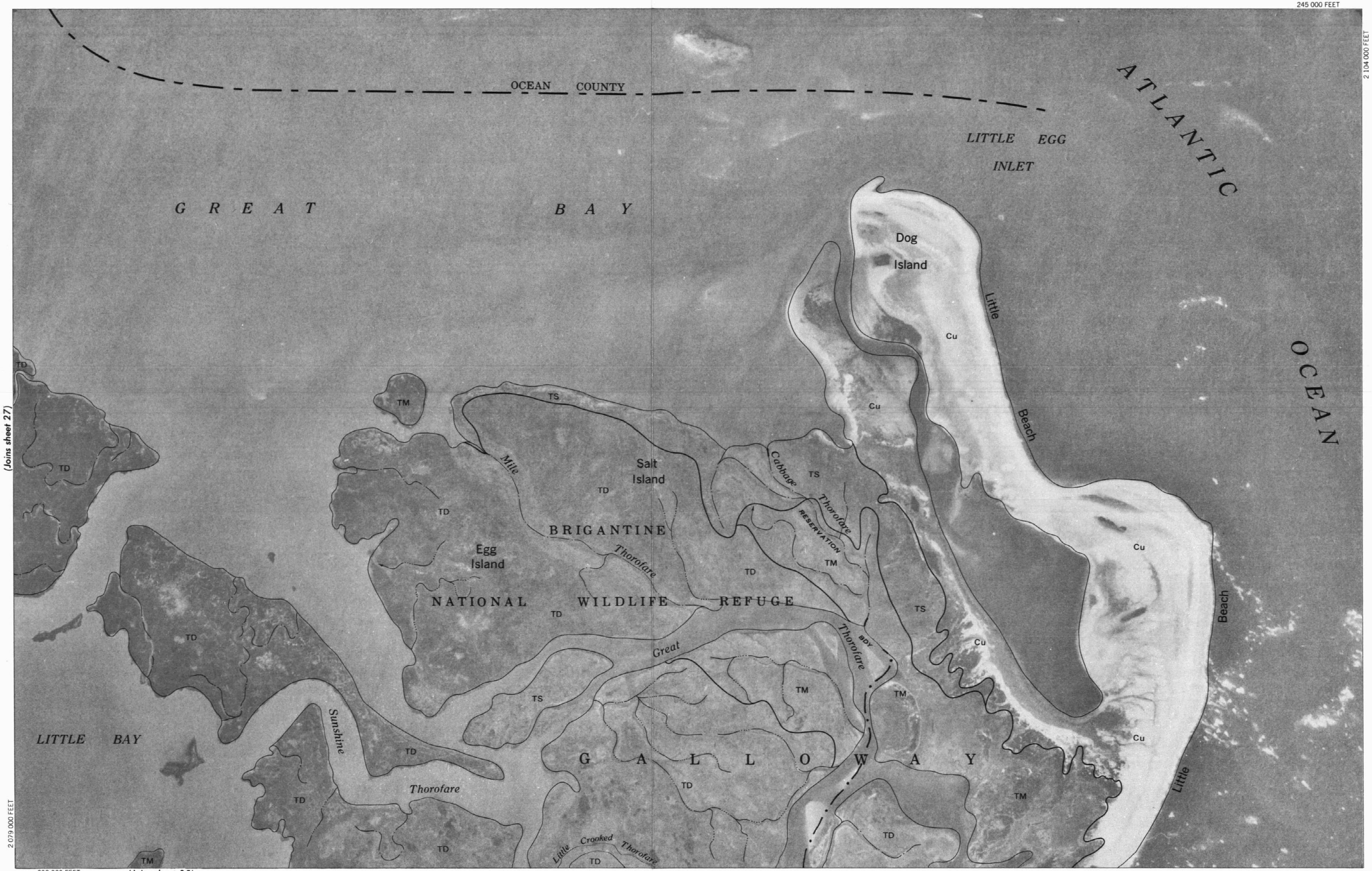
0 — ¼ — ½ — ¾ — 1

0 — 1 000 — 2 000 — 3 000 — 4 000 — 5 000

(Joins sheet 27)

245 000 FEET

2 104 000 FEET



2 079 000 FEET

229 000 FEET

(Joins sheet 35)

This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.

ATLANTIC COUNTY, NEW JERSEY NO. 28

ATLANTIC COUNTY, NEW JERSEY NO. 29

This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.

ATLANTIC COUNTY, NEW JERSEY — SHEET NUMBER 30

This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Positions of grid lines are approximate and based on the New Jersey coordinate system.

(Joins sheet 24)

229 000 FEET

1 979 000 FEET

(Joins sheet 30)

(Joins sheet 32)

(Joins sheet 38)

2 004 000 FEET

213 000 FEET

N

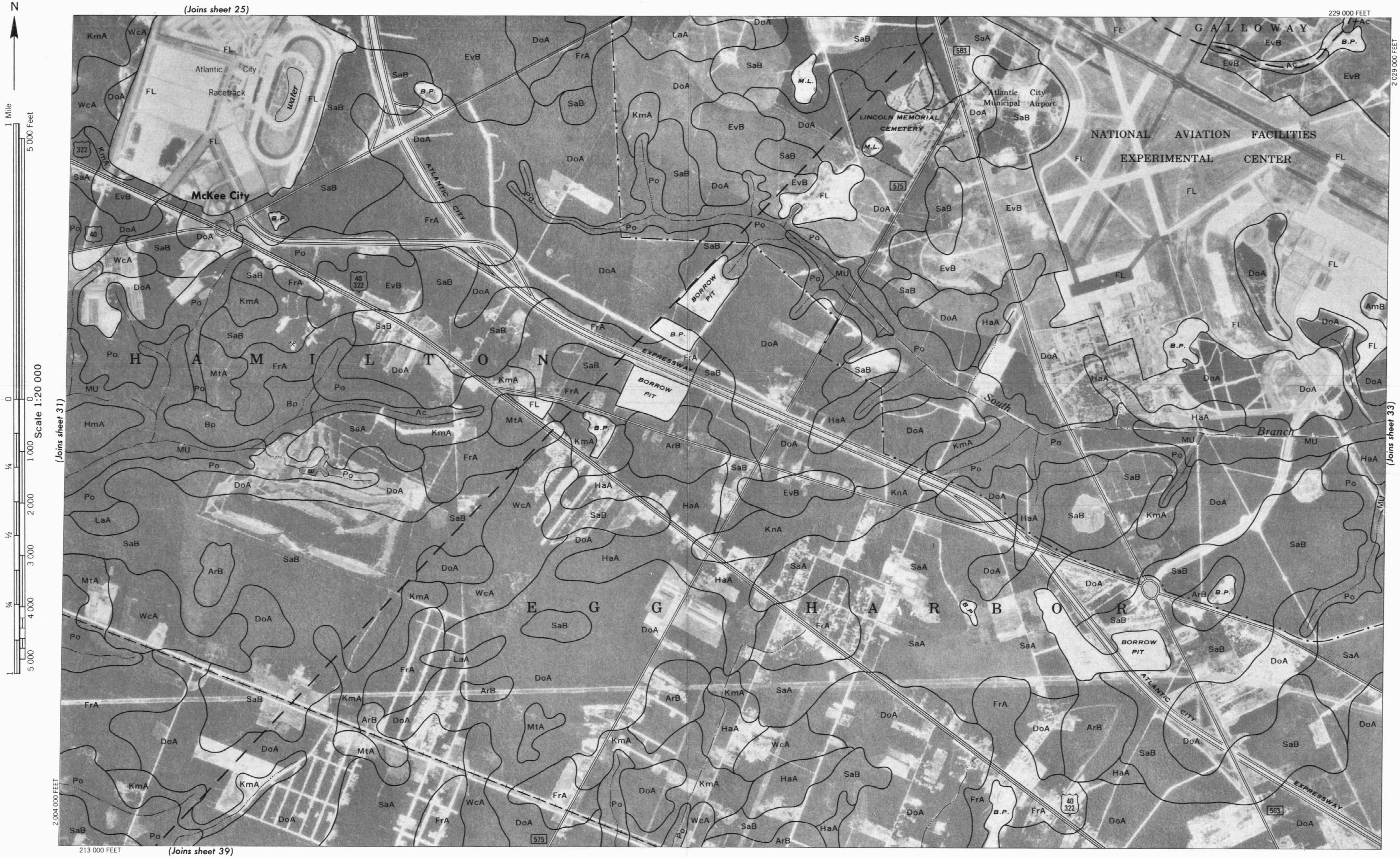
Scale 1:20 000

1 Mile — 5 000 Feet

ATLANTIC COUNTY, NEW JERSEY NO. 31

This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Positions of grid lines are approximate and based on the New Jersey coordinate system.

ATLANTIC COUNTY, NEW JERSEY — SHEET NUMBER 32



This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.

(Joins sheet 26)

229 000 FEET

2 029 000 FEET

(Joins sheet 32)

(Joins sheet 34)

(Joins sheet 40)

213 000 FEET

2 054 000 FEET

N

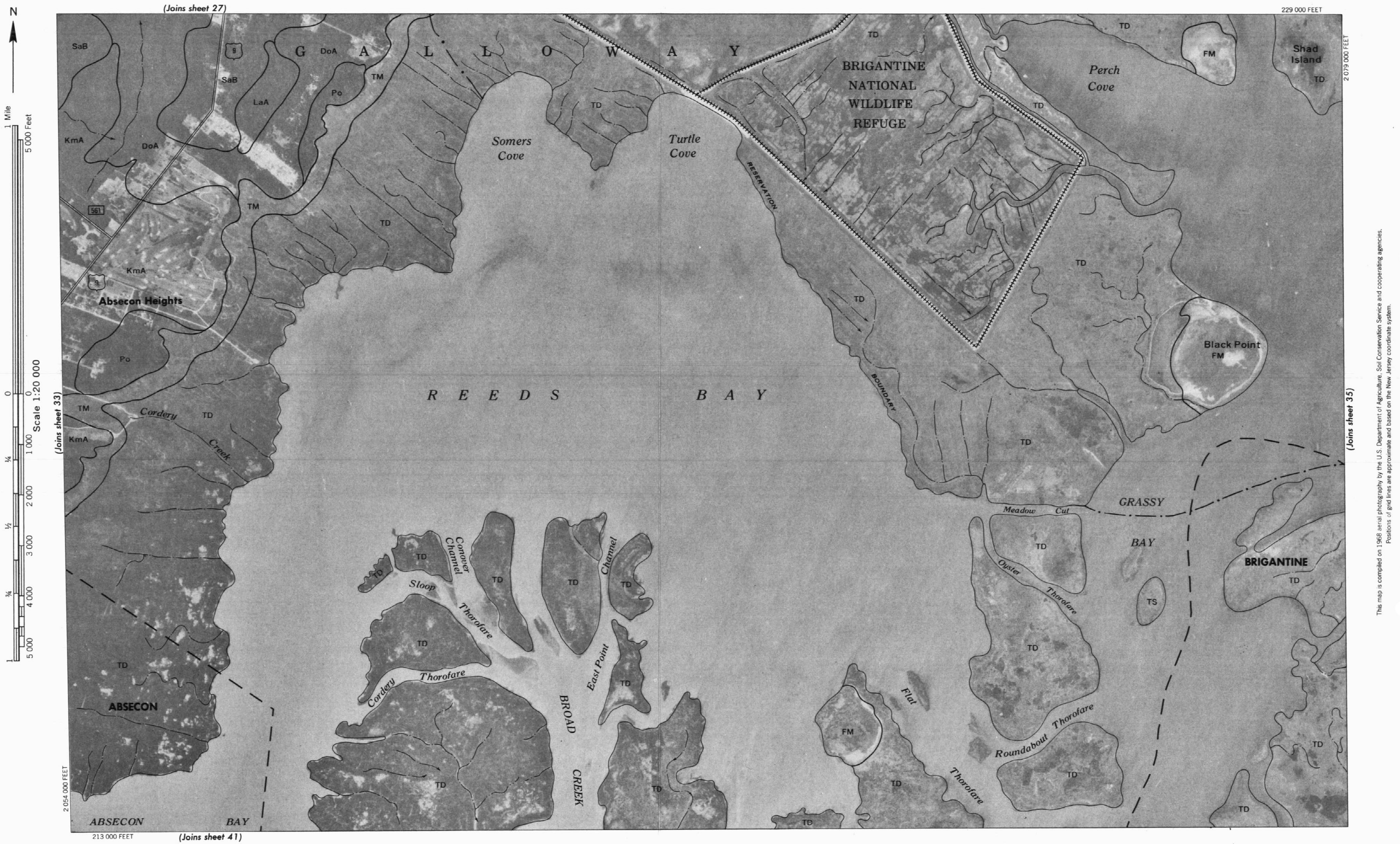
Scale 1:20 000

0 — ¼ — ½ — ¾ — 1 Mile

0 — 1 000 — 2 000 — 3 000 — 4 000 — 5 000 Feet

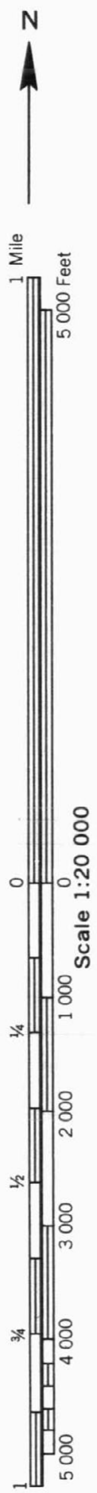
ATLANTIC COUNTY, NEW JERSEY NO. 33

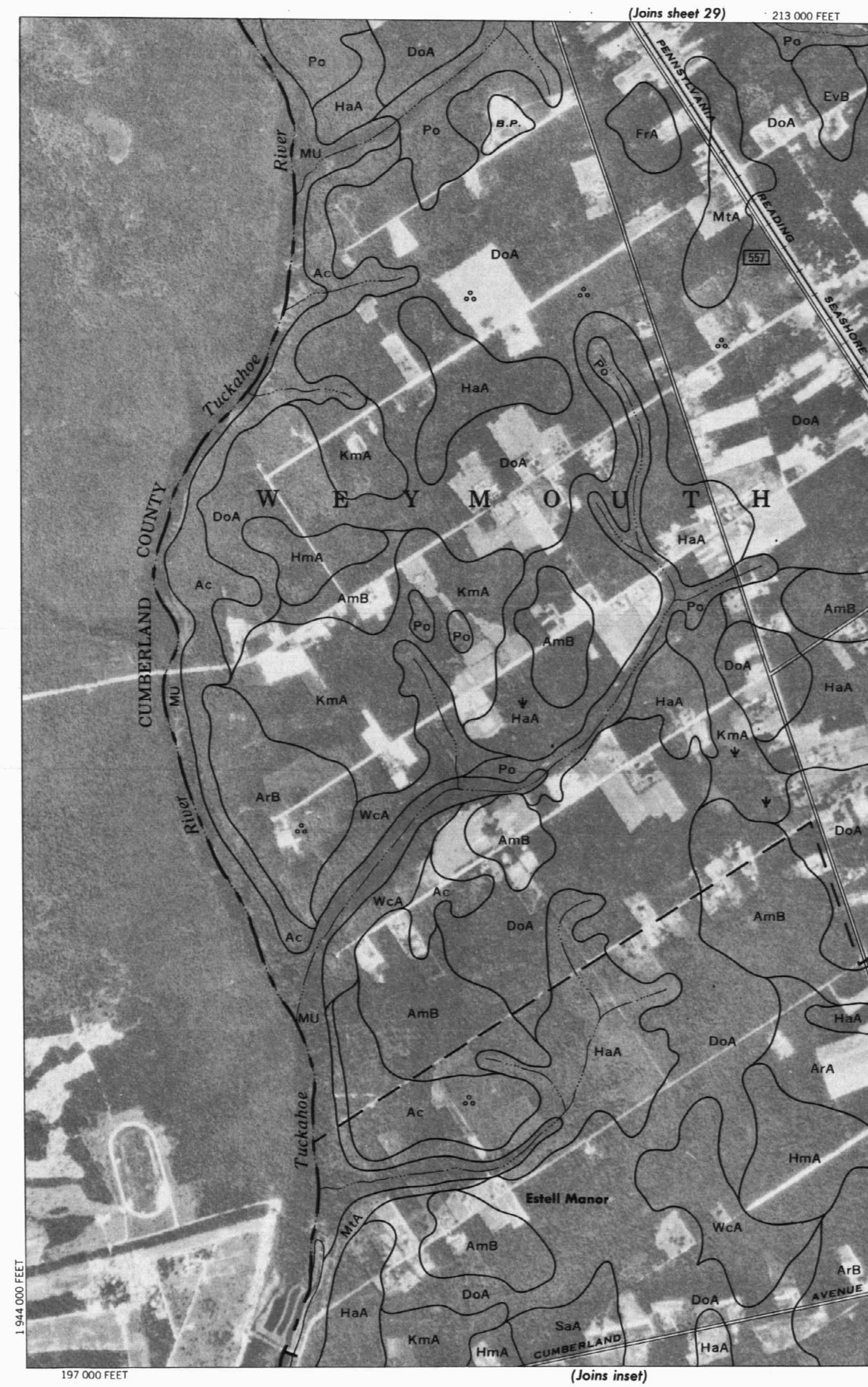
This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Positions of grid lines are approximate and based on the New Jersey coordinate system.


N
Scale 1:20 000
1 Mile
5 000 Feet
(Joins sheet 27)
(Joins sheet 33)
(Joins sheet 35)
(Joins sheet 41)
229 000 FEET
2 079 000 FEET
2 054 000 FEET
213 000 FEET
G A L L O W A Y
BRIGANTINE NATIONAL WILDLIFE REFUGE
Somers Cove
Turtle Cove
Perch Cove
Shad Island
Black Point
RESERVATION
BOUNDARY
Absecon Heights
R E E D S B A Y
Cordery Creek
GRASSY BAY
Meadow Cut
Oyster Thorofare
BRIGANTINE
Conover Channel
Sloop Thorofare
Cordery Thorofare
Channel
East Point
BROAD CREEK
Flat
Thorofare
Roundabout Thorofare
ABSECON
ABSECON BAY
SaB
DoA
LaA
Po
TM
KmA
TD
FM
TS
This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.
ATLANTIC COUNTY, NEW JERSEY NO. 34

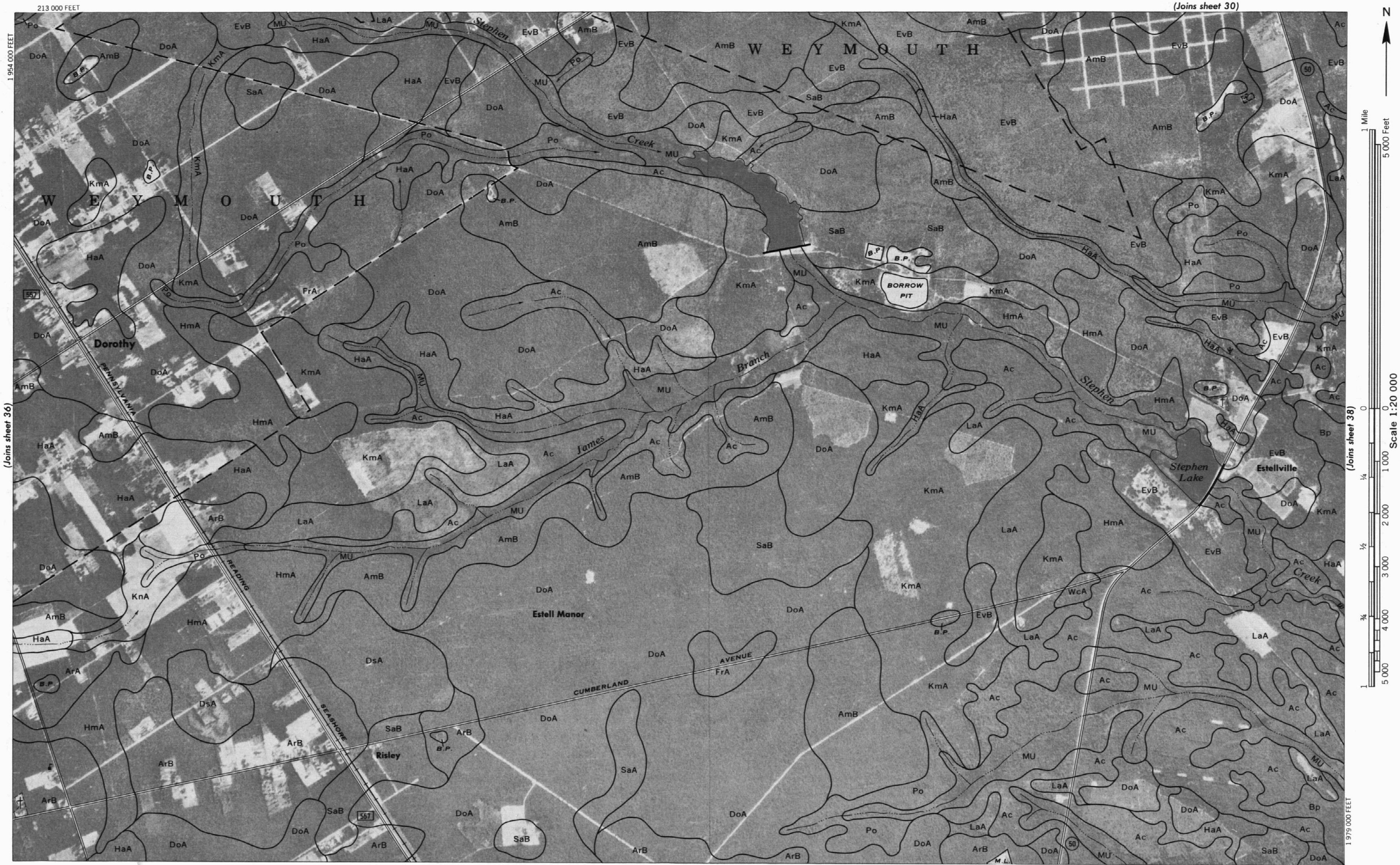
ATLANTIC COUNTY, NEW JERSEY NO. 35

This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.





This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.



ATLANTIC COUNTY, NEW JERSEY NO. 37

This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Positions of grid lines are approximate and based on the New Jersey coordinate system.

This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.

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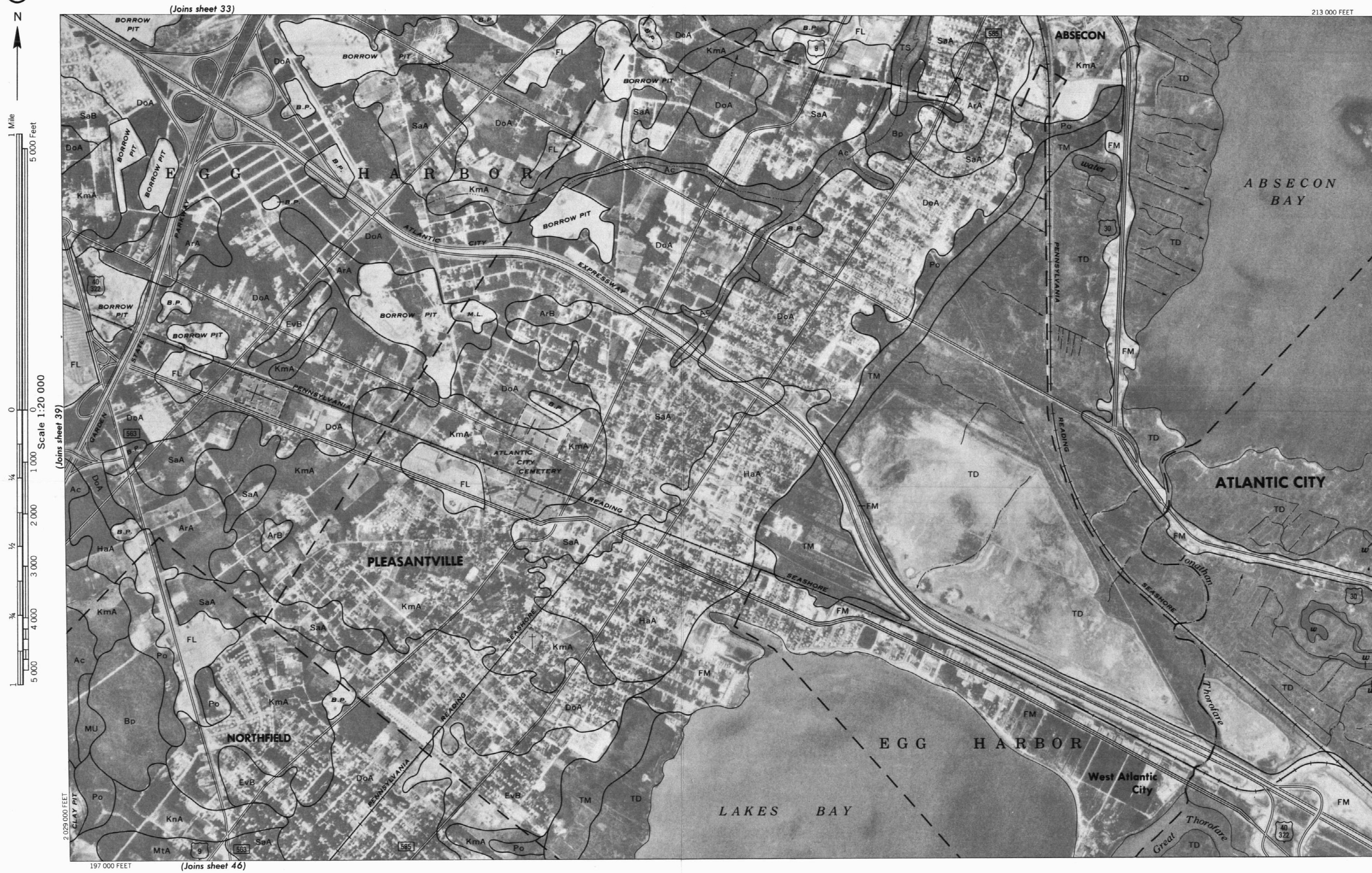
Positions of grid lines are approximate and based on the New Jersey coordinate system.



This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.

ATLANTIC COUNTY, NEW JERSEY NO. 41

This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.

ATLANTIC COUNTY, NEW JERSEY — SHEET NUMBER 42

N

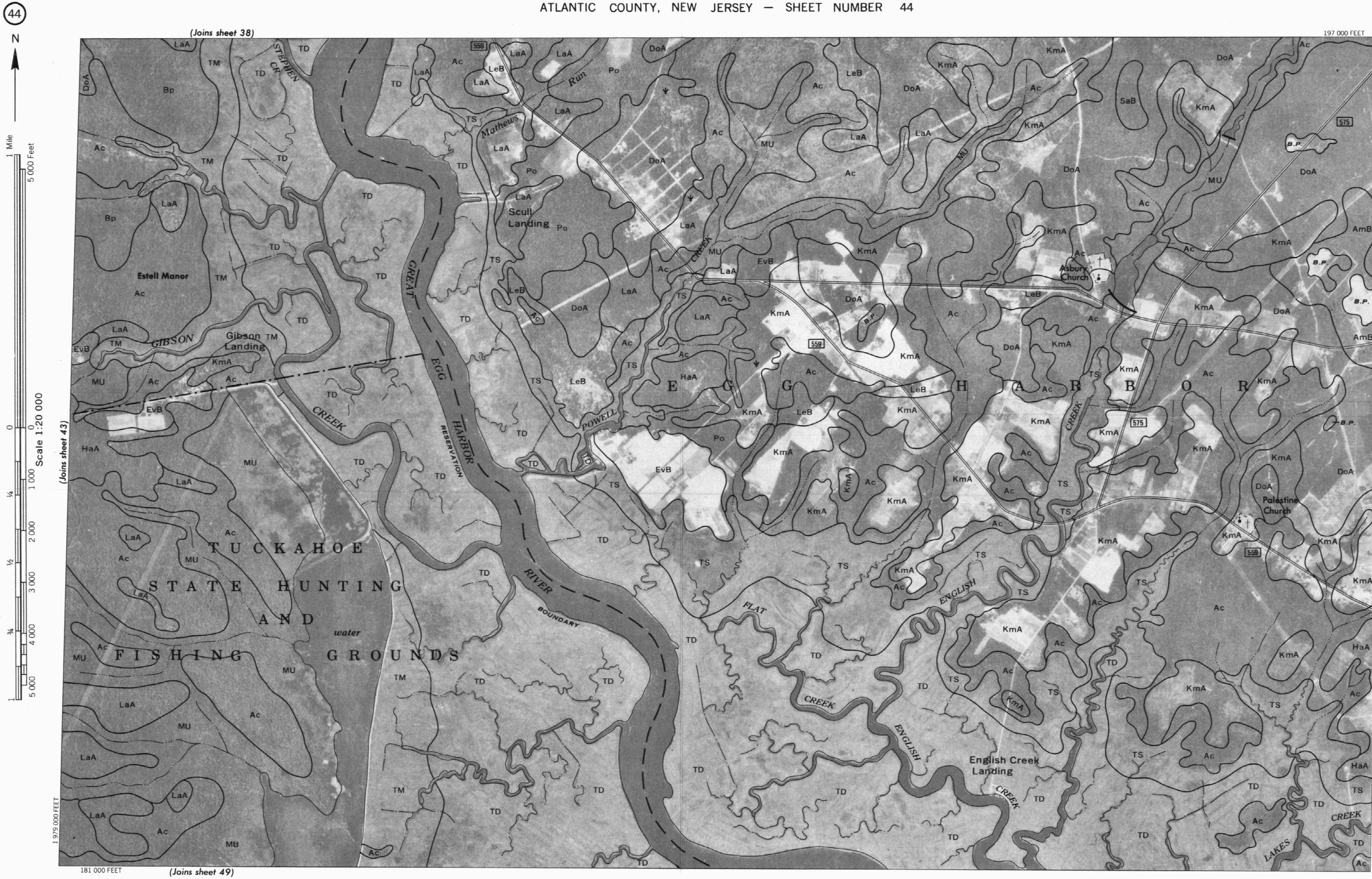
Scale 1:20 000

1 Mile ¾ ½ ¼ 0

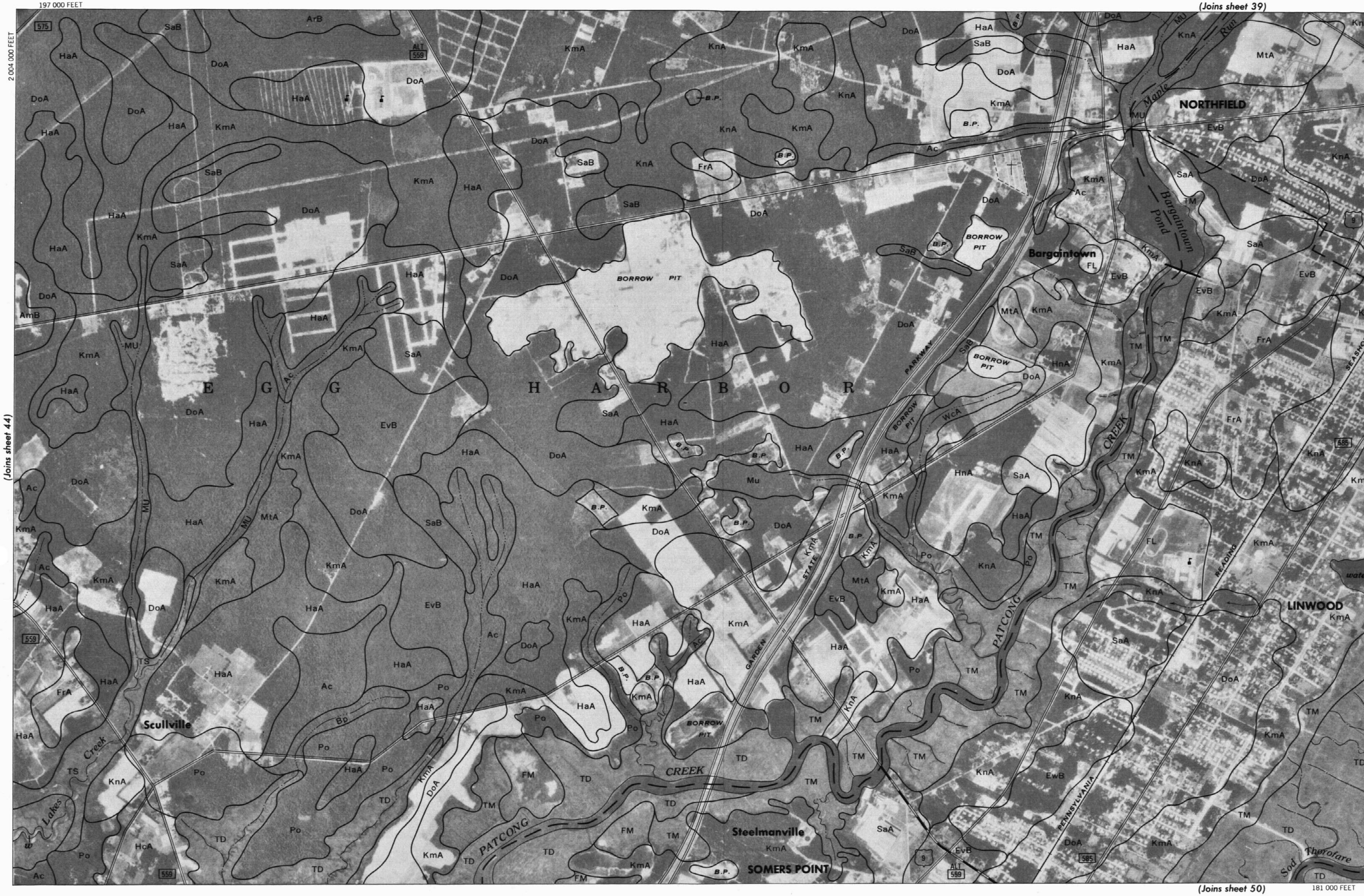
5 000 Feet 4 000 3 000 2 000 1 000 0 5 000

This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.

ATLANTIC COUNTY, NEW JERSEY NO. 43
This map is compiled on 1958 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.



This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.



N

1 Mile

5 000 Feet

Scale 1:20 000

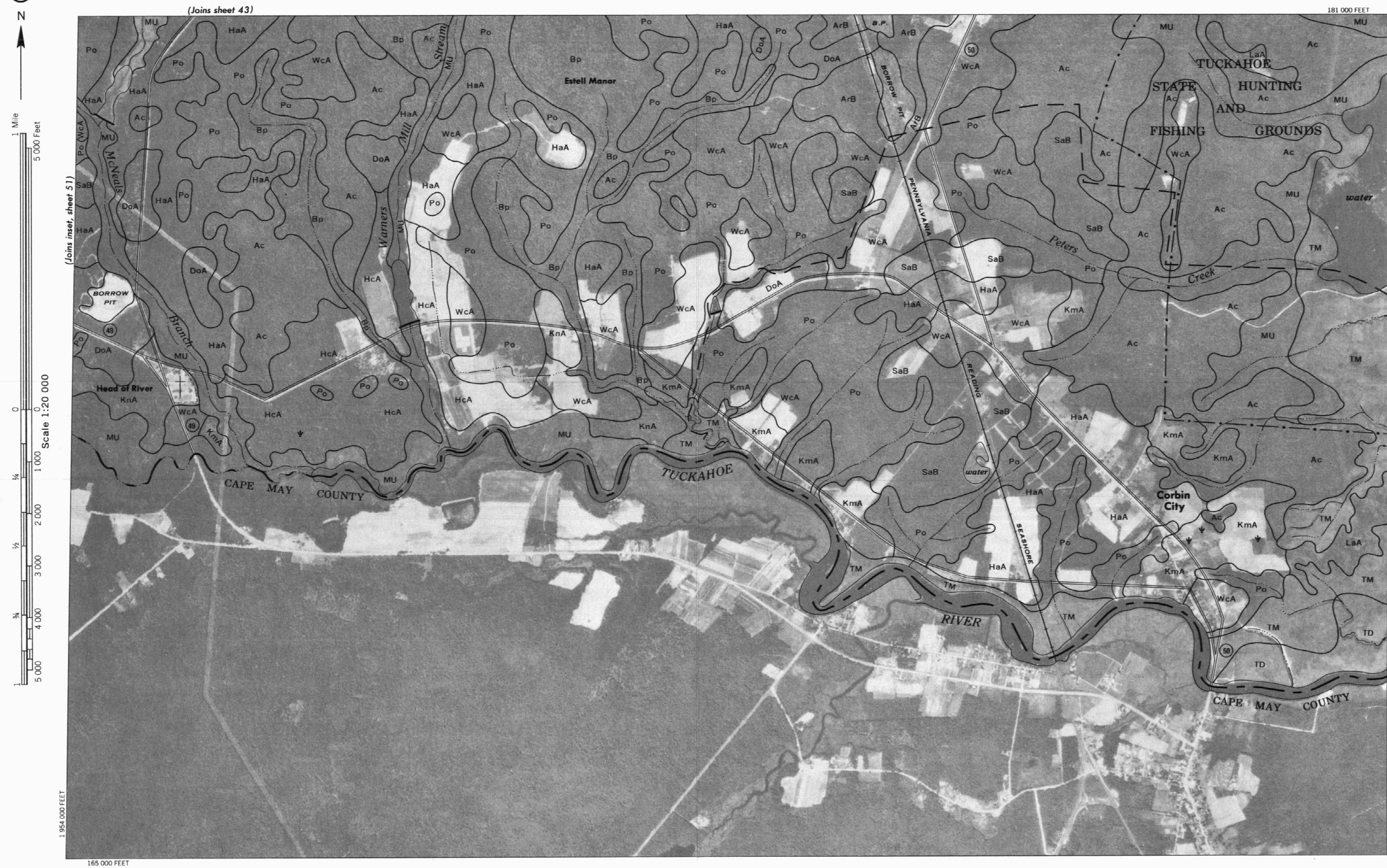
ATLANTIC COUNTY, NEW JERSEY NO. 45

This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.

This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Positions of grid lines are approximate and based on the New Jersey coordinate system.

ATLANTIC COUNTY, NEW JERSEY NO. 46

This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Positions of grid lines are approximate and based on the New Jersey coordinate system.



This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Positions of grid lines are approximate and based on the New Jersey coordinate system.

ATLANTIC COUNTY, NEW JERSEY NO. 48

N

Scale 1:20 000

1 Mile — ¾ — ½ — ¼ — 0

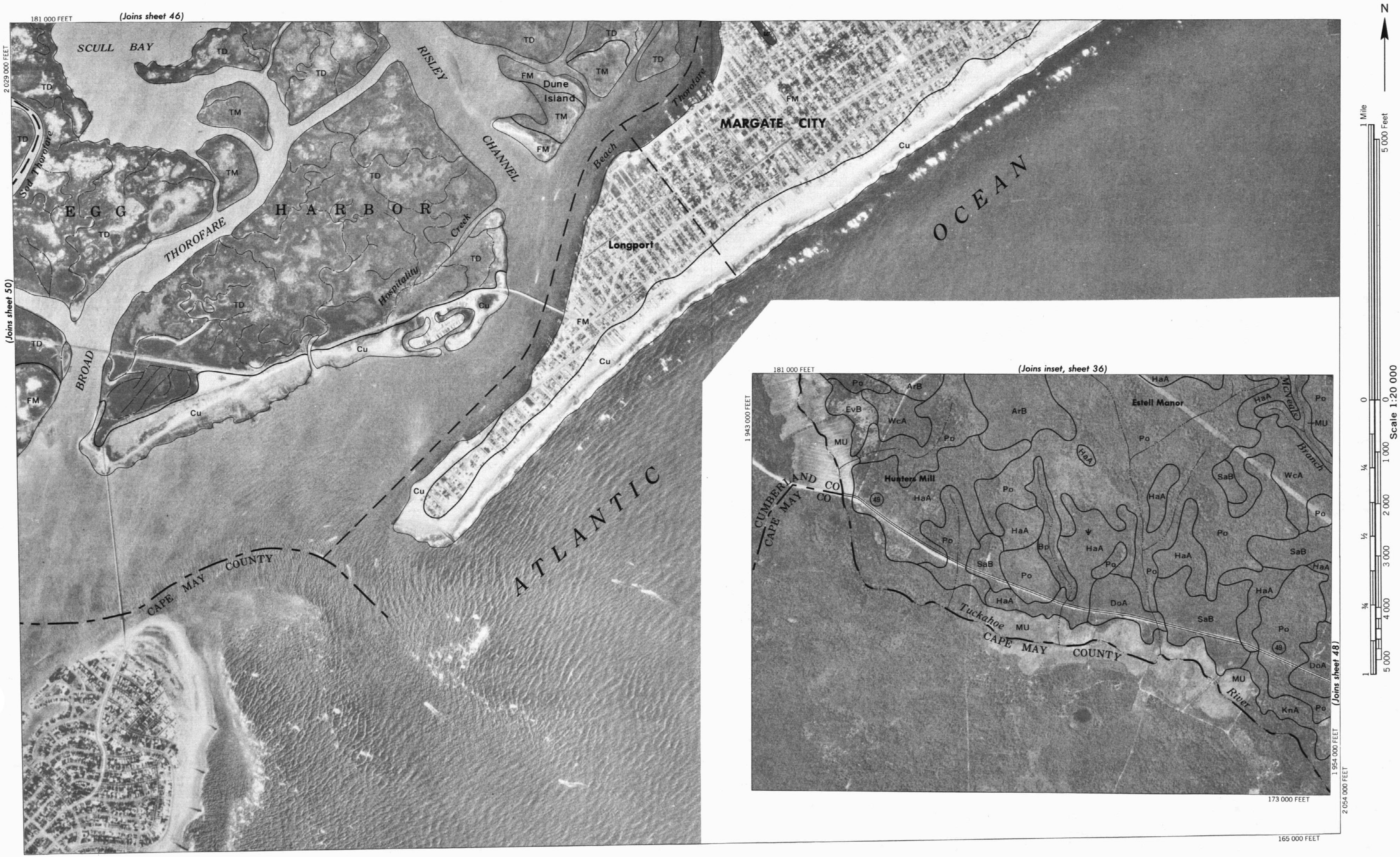
5 000 Feet — 4 000 — 3 000 — 2 000 — 1 000 — 0

1 — 5 000

ATLANTIC COUNTY, NEW JERSEY NO. 49

This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.

This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies.
Positions of grid lines are approximate and based on the New Jersey coordinate system.



ATLANTIC COUNTY, NEW JERSEY NO. 51

This map is compiled on 1968 aerial photography by the U.S. Department of Agriculture, Soil Conservation Service and cooperating agencies. Positions of grid lines are approximate and based on the New Jersey coordinate system.